

STRATEGIC PLAN

2006 – 2012



Approved by the
**TENNESSEE WILDLIFE
RESOURCES COMMISSION**
March, 2006



STRATEGIC PLAN 2006 – 2012

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Tennessee Wildlife Resources Agency

Strategic Plan 2006-2012

Introduction:

Tennessee's natural resources are as diverse as any in the nation. From the rugged Appalachian Mountains in the east to the Mississippi River floodplain in the west, the changes in elevation, land use, geology, and topography create a wide range of habitat types that gives rise to a great diversity of wildlife.

Protecting these diverse habitats and the associated wildlife is a quality-of-life issue for many Tennesseans. Both the traditional, consumptive users of wildlife (hunters and anglers) and the non-consumptive users (wildlife watchers) have a stake in the proper management of wildlife.

Recreational boaters expect to find clean water, adequate boating facilities, and a dedication to boater safety.

This Strategic Plan strives to anticipate the needs of the wildlife and the public, and to develop strategies that will protect, enhance, and effectively manage our wildlife resources. Some of the major changes since the previous Strategic Plan was developed in 2000 include the reintroduction of elk to Tennessee, increased federal funding for non-game wildlife, and mandatory boater education.

Who we are:

The Tennessee Wildlife Resources Agency is the State agency responsible for the management of wildlife including game animals, non-game species, fish, and endangered species. TWRA is also the agency responsible for promoting boating safety. We are an organization of over 600 individuals who are dedicated to managing Tennessee's natural resources.

What we do:

The Tennessee Wildlife Resources Agency: operates fish hatcheries that provide fish to stock public waters throughout the State; manages wildlife habitat on its Wildlife Management Areas and promotes habitat improvement on private lands; enforces game and fish laws; monitors fish and wildlife populations; educates the public about conservation; provides boating education and enforces boating safety laws; and provides opportunities for the public to hunt, fish, and watch wildlife.

Vision:

The Tennessee Wildlife Resources Agency will use scientific principles in the management of fish and wildlife, provide opportunities for the prudent use of natural resources, foster public awareness of environmental and safety issues, and merit public confidence, respect, and support.

Mission:

The mission of the Tennessee Wildlife Resources Agency is to preserve, conserve, manage, protect, and enhance the fish and wildlife of the state and their habitats for the use, benefit, and enjoyment of the citizens of Tennessee and its visitors. The Agency will foster the safe use of the state's waters through a program of law enforcement, public education, and access.

History:

In 1949 the Tennessee Game and Fish Commission separated from the Department of Conservation and became a self supporting agency. A board of commissioners guided the agency, which was headed by the executive director. In 1974 the agency became the Tennessee Wildlife Resources Agency, reflecting its responsibility for all wildlife. In 1977 the first Strategic Plan was developed and the agency began administering its federal aid program through a comprehensive management system. The Agency's Strategic Plan has been revised and updated several times with a new Plan published in 1982, 1987, 1994, and 2000. The Agency continues to have a board of commissioners as the governing body, with the Executive Director in charge of day-to-day activities. TWRA has approximately 600 employees, of which about one-fourth are full-time enforcement officers. The Agency owns nearly 400,000 acres of Wildlife Management Areas, Refuges, and Agency fishing lakes. TWRA's funding mechanisms are divided into three broad areas: wildlife (including fish), boating, and wetlands. Funding for the wildlife program is generated primarily by license sales and federal funding. The boating safety program is funded through boat registration fees and federal funding. The wetland acquisition program is funded by a transfer tax on Tennessee real estate transactions.

Public involvement:

Communication with the public is a continuous process for TWRA. We inform the public of agency projects and programs through new releases, the agency's magazine, an Internet web site, and a weekly TV show. More importantly, we receive feedback from the public through phone calls, e-mail links on our web site, semi-annual phone surveys, and at public forums such as commission meetings, hunter education classes, hunter check stations, free fishing day events, etc.

For this Strategic Plan, public input was sought by mailing copies of the draft plan to interested persons/organizations and by posting the draft on the internet and publicizing its availability. The internet site received over 600 hits. Comments were forwarded to the appropriate committee chairman for consideration in revising the Plan.

Statutory and Regulatory Requirements Affecting the Strategic Plan:

Title 70 of Tennessee Code Annotated contains the laws governing the Wildlife Resources Agency. In Chapter 1, "Part 3- Wildlife Resources Agency" includes:

70-1-301. Creation – Statement of Policy.- (a) There is hereby created a wildlife resources agency which shall have full and exclusive jurisdiction of the duties and functions relating to wildlife formerly held by the game and fish commission or of any other law relating to the management, protection, propagation, and conservation of wildlife, including hunting and fishing, except those powers and duties

conferred upon the wildlife resources commission as provided in § 70-1-206. *(note: § 70-1-206 defines the duties of the Wildlife Resources Commission, which include appointing the executive director, approving the budget, and promulgating rules, regulations, and proclamations)*

(b) It is the policy of the state that the agency shall be nonpartisan and shall place first and foremost the welfare of the wildlife and its environment in the agency's planning and decisions, and to encourage, by every appropriate means, the full development of the state's natural resources to the benefit of all of the citizens of Tennessee, including, but not limited to, the creation of a comprehensive long-range management plan to integrate the wildlife resource agency's efforts and to implement and encourage full utilization of Tennessee's wildlife resources consistent with realistic conservation principles.

Chapter 4 of Title 70 includes:

70-4-101. Ownership and title to wildlife vested in state.- (a) The ownership of and title to all forms of wildlife within the jurisdiction of the state, as are not individual property under the laws of the land, are hereby declared to be in the state.

Agency Systems:

In addition to the programs outlined within the Strategic Plan, it should be noted that TWRA also administers business management systems. License sales, revenue collection, budgeting and bill payment, and computer system support are among the day-to-day processes that must occur in order to keep the Agency running. While these processes don't relate directly to the program goals within this Strategic Plan, they are essential to achieving any of the Agency's goals.

Likewise, while they not separate chapters within this Strategic Plan, law enforcement and information/education are significant functions that are integral to the success of the Agency. This Strategic Plan is a part of TWRA's Comprehensive Management System (CMS). Only five states have developed a CMS that is approved by the US Fish and Wildlife Service as a mechanism for obtaining federal assistance funding. A separate CMS document is available that details TWRA's method of planning and cost accounting.

Strategic Planning Process/Methods:

The basic concept of strategic planning is that knowledgeable people will develop ambitious but realistic goals and objectives; they will identify problems, issues, or opportunities that affect those goals and objectives, and then develop strategies to deal with the problems, issues, and opportunities.

In January, 2005 a committee chairperson was selected for each of the nineteen programs in this Strategic Plan. In February, these chairpersons gathered in Nashville for training conducted by the Management Assistance Team from the National Conservation Training Center.

Chairpersons selected their committee members and conferred in-person, by phone, and by e-mail to develop a first draft of the Plan. Committee members were selected based on their

expertise and their ability to contribute to the Plan. They used brain-storming methods, review of the prior Strategic Plan, review of other plans, and their personal knowledge of current issues to devise a new Plan.

The first draft of the Plan was circulated within TWRA and reviewed primarily for consistent content and formatting. Chairpersons then submitted a revised plan, and this second draft was subjected to public review. The third draft was reviewed/revised by the Director's staff. The fourth draft was submitted for Commission review/approval, which resulted in the final Strategic Plan.

Economics of Wildlife:

Every five years the US Fish and Wildlife Service conducts a national survey to determine the number of users and the economic impact of hunting, fishing, and wildlife-associated recreation.¹ According to their 2001 report, there are 903,000 anglers in Tennessee that annually spend over fifteen million days fishing, spending \$480,221,000. Our 359,000 hunters spend over six million days afield each year and spend \$588,691,000. And Tennessee's two million wildlife-watchers spend \$448,543,000 each year. In fact, *just* the state sales tax on *just* the equipment for these activities totals over \$30 million per year.

Using this Plan

TWRA's Strategic Plan is an important part of the Agency's comprehensive management system. It will be used to inform the public of the Agency's goals and priorities; it is used in the evaluation and scoring of project proposals which form the Agency's work plan and budget; and every three years we will evaluate the accomplishments toward the objectives and strategies of the Strategic Plan.

¹ U.S. Department of the Interior, Fish and Wildlife Service and U.S. Department of Commerce, U.S. Census Bureau. *2001 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation*.

Program Rank:

The nineteen programs were ranked for their importance and assigned a numerical score that will be used in evaluating project proposals.

<u>PROGRAM</u>	<u>SCORE</u>	<u>PROGRAM</u>	<u>SCORE</u>
Streams	25	Farm Game	17
Reservoirs	25	Dove	17
Deer	24	Squirrel	16
Turkey	22	Elk	15
Boating	20	Bear	14
Large Rivers	19	Grouse	13
Community Fishing	18	Furbearers	12
Nongame/End. Spp.	18	Boar	10
Waterfowl	17	Commercial Fishing	10
		Commercial Mussels	10

CURRENT AND PROJECTED STATUS

Black bears (*Ursus americanus*) are an important wildlife resource of the forests of Tennessee. Tennessee's bear management program has become an emerging success story. Strong enforcement of game laws and effective management techniques has resulted in increasing populations and harvests. However, the status of Tennessee's bear population hasn't always been so healthy.

Tennessee's bear population is shared with the states of Georgia, North Carolina, and South Carolina. Collectively, this population is known as the Southern Appalachian population. Recognition that bear management in the adjoining states might impact Tennessee's bear program resulted in the formation of the Tri-State Black Bear Study team in 1976, composed of the states of Georgia, North Carolina, and Tennessee. This group completed its report on the status of the black bears in the southern Appalachians in 1983 (Carlock *et al.* 1983). In 1990, the group was re-formed, and expanded to include the state of South Carolina, which has a small population in the western portion of that state. The group is now known as the Southern Appalachian Black Bear Study Group (SABBSG) and meets semi-annually to share data and information, and discuss issues pertinent to bear management. Presently, bears exist in adequate numbers in eleven Tennessee counties (Blount, Carter, Cocke, Greene, Johnson, Monroe, Polk, Sevier, Sullivan, Unicoi, and Washington) along the eastern border of the state. According to recent estimates, the Southern Appalachian region (excluding Virginia) supports a population of approximately 9,000 bears, of which 1,200 to 1,500 are estimated to be in Tennessee (anonymous). The Southern Appalachian Region is depicted in Figure 1.

In addition to the Southern Appalachian population found in eastern Tennessee, there is a disjunct population present in the Big South Fork region of Tennessee and Kentucky, comprised of Campbell, Fentress, Morgan and Scott counties in Tennessee. This population is a result of a repatriation project initiated in 1995 (Eastridge and Clark 2001).

The current status of Tennessee's black bear population is good. Bait station surveys, conducted annually since 1981, indicate that the population increased significantly during the 1980's (Figure 2). The legal harvest of bears further indicates a relatively abundant bear population (Figure 3).

PAST, PRESENT AND FUTURE USE

Historically, black bears existed throughout the state of Tennessee. Dramatic land use changes resulted in the decline of black bear populations by the 1880's, with bears present only in the forested areas of the eastern part of the state. Further population declines occurred due to large scale logging, subsequent habitat destruction, and excessive hunting and trapping in the period from 1900 to 1930. As a result, bears were only present in a few isolated areas of Tennessee, North Carolina, and Georgia by the 1930's. With the

establishment of the Great Smoky Mountain National Park (GSMNP), the Chattahoochee (GA), Pisgah (NC), Nantahala (NC), and Cherokee (TN) National Forests in the 1930's, it appeared that black bears would return to some of their former range as vegetation matured and wildlife was protected by state and federal agencies. However, the American chestnut blight became established in the 1940's, and significantly impacted the forests and wildlife resources of the Southern Appalachians. Bear populations apparently declined again.

Prior to the 1970's, there is a general paucity of reliable information on the status of bear populations in Tennessee. We do have records from bear hunting seasons starting in 1951, and we also know that the season was closed after the 1969 season for 3 years, 1970-72, because of concerns over low bear populations. The year 1973 more or less marks the beginning of Tennessee's modern era in black bear management.

In recent years, Tennessee's bear management program has focused on four primary issues: 1) enforcement of game laws to reduce the illegal kill; 2) protection of the female segment of the population, and; 3) efforts to minimize habitat degradation; and 4) bear / human complaints.

Law enforcement has been a key component of the bear management program for a number of years. Protection of female bears from excessive hunting mortality was further enhanced in 1981 with the establishment of a late hunting season. This simple change in hunting strategy reduced the percentage of females in the harvest from 56% before 1981 to about 37%, even though the total harvest has increased substantially since 1981.

The protection of females from excessive hunting mortality is considered to be an important aspect of the overall bear management program. In 1973, 4 sanctuaries with no bear hunting were established on a total of 136,000 acres, with the purpose of creating nucleus areas of breeding females protected from hunting. In 1997, two new bear sanctuaries in the northeastern portion of Tennessee were added to the sanctuary system: Laurel Fork Bear Sanctuary (34,529 acres) and Kettlefoot Bear Sanctuary (39,190 acres). Including GSMNP (241,000 acres), where hunting is prohibited, there are a total of 450,413 acres of bear sanctuaries in Tennessee.

Protection of female bears from excessive hunting mortality was further enhanced in 1981 with the establishment of a late hunting season. This simple change in hunting strategy reduced the percentage of females in the harvest from 56% before 1981 to about 37%, even though the total harvest has increased substantially since 1981. However, since 1990, the percentage of females in the harvest has increased somewhat, to around 42% annually. For the 2000 to 2004 period, the percentage of females in the harvest returned to lower levels, averaging 35%.

Habitat degradation is a more problematic issue, and certainly less understood. The forests of eastern Tennessee have changed over the last 60 years to a system in which the American chestnut, a reliable mast producer, has been replaced by oaks, which are less reliable. The oak forests are maturing, with over 70% of the forests in the Southern Appalachians in mid-to late-successional stages (Southern Appalachian Assessment, 1996). Other issues which are of concern in relation to black bear habitat include hard mast availability, density of roads, and availability of denning habitat. To address these issues, the Agency has supported efforts to develop habitat models which can quantitatively monitor and measure the effects of changes in key habitat factors.

Bear-human conflicts continue to be a management dilemma for TWRA with the worst problems occurring in Gatlinburg. Many Gatlinburg businesses and restaurants store their garbage in a manner that is environmentally insensitive and extremely detrimental to bears. In extreme cases, some businesses even intentionally feed bears to attract tourists. The irresponsible behavior of intentional and unintentional feeding of bears results in a death trap for bears in Gatlinburg.

To address these problems, first, both state and city regulations were passed in 2000 making it unlawful to feed bears and store garbage in a manner that is accessible to bears in Gatlinburg. Secondly, the TWRA, Great Smoky Natural History Association, and the city of Gatlinburg have joined in a cooperative effort and funded a position in 2002 to address the many problems with garbage and bears in Gatlinburg. All parties involved have clearly benefited from the cooperative effort with the establishment of an area pro-active bear management program. Specifically, these efforts have resulted in fewer human / bear conflicts and a safer environment for residents and visitors.

During the next 15 years, it is uncertain as to whether the public use of Tennessee's bear resource will increase or decrease. To determine and monitor the number of persons hunting bears in Tennessee, it may be necessary to implement a permit system. This could allow the TWRA to better manage the resource.

Harvest Information

Black bear hunting seasons were established in Tennessee in the early 1930's. Harvest records have been kept since 1951. Regulations changed little until 1970 when the season was closed through 1972 because of low population levels. Since 1973, and prior to 1997, Tennessee's legal bear harvest has ranged from a low of 9 in 1975, to a high of 370 in 1997 (Figure 3).

Some of the increase in the legal harvest can be attributed to the establishment of a 5-day October season in counties surrounding GSMNP, which was first initiated in 1987. Depending on the year and the availability of hard mast within GSMNP, this early season has produced between 2 and 253 bears in the total harvest. The early season has been most

successful during years when hard mast was scarce within the Park, resulting in greater bear movements outside GSMNP, and a higher bear harvest.

In 1997, there was also an expansion of bear hunting opportunities in three northeastern Tennessee counties: Carter, Johnson, and Sullivan counties. These 3 counties were opened for the first time with a 5-day hunt in December, 1997, harvesting a total of 12 black bears. Since 2000, these 3 counties have averaged a harvest of 26 bears a year. In 2003, the TWRA established a 2-day still hunt in October 2003 in Johnson County to focus hunting efforts to bears damaging agricultural fields.

SUMMARY

Because of the successful re-establishment of black bear populations throughout the species' range in the Southern Appalachian region, the challenges in managing this species have changed since the 1970s and 1980s. With growing populations have come nuisance concerns and associated costs in equipment and manpower. The black bear, while a valuable and unique resource, is no longer in jeopardy. Bear populations have reached a cultural, if not a biological carrying capacity in many areas. Recognizing this fact and the fact that additional quality habitat for bears is limited in Tennessee, brings us to a crossroads in the management of this species. Some strategies set forth in this strategic plan represent an effort to address these issues with a new approach and fundamentally a new philosophy in management.

GOALS

Maintain existing bear population levels in the Southern Appalachian Ecosystem.

Increase bear population levels and expand the range of black bears in the Cumberland Plateau ecosystem.

Increase the associated recreational opportunities and minimize the loss of bear habitat.

OBJECTIVES

1. Increase the average annual harvest to 180 bears.
2. Address issues of reintroducing black bears to the Cumberland Plateau ecosystem.
3. Update management protocol for collecting data, trapping, handling, and relocating bears.
4. Develop informational and educational material (e.g., website) for the public on how to avoid creating problems with bears.

I. Problem – Deterioration of habitat quantity and quality.**Strategies**

1. Identify critical bear habitat currently not protected and aggressively pursue ways to secure these areas. Additionally, assist the United States Forest Service (USFS), National Park Service (NPS), Nature Conservancy and Foothills Conservancy in establishing policies that enhance and protect critical bear habitat.
2. Utilize new GIS-based bear habitat model to develop habitat management guidelines for the Cherokee National Forest.
3. Support forest management that insures habitat diversity.

II. Problem – Nuisance bears cause conflicts with the public and cause a significant drain on TWRA resources.**Strategies**

1. Implement an aggressive I & E program to teach the public how to deal with nuisance bears.
2. Seek new alternatives to address nuisance bear complaints including utilizing private ADC personnel and issuance of more depredation permits.
3. Seek partners among groups and municipalities for alternative funding for bear management, using the Gatlinburg partnership as a model.
4. Continue partnership with the USFS and the GSMNP to relocate nuisance bears within suitable habitat on public lands in Tennessee.
5. Develop training programs for the efficient and safe capturing, immobilization, and handling of black bears.
6. Standardize protocol for managing nuisance bears.
7. Maintain adequate hunting seasons to control bear numbers.

III. Problem – Limited opportunity of expansion of present bear range.**Strategies**

1. Address issues impacting bear range expansion.
2. Educate local public in bear population areas to the consumptive and non-consumptive benefits of having a bear population.
3. Reintroduce bears to the Cumberland Plateau ecosystem.

IV. Problem – Illegal hunting activity results in fewer bears that can be enjoyed both through hunting and non-consumptive recreational activities.**Strategies**

1. Maintain bear sanctuaries to insure protection of adult females.
2. Assist the USFS in establishing road policies that limit vehicle access into protected areas.

3. Utilize innovative law enforcement techniques, including aircraft surveillance to address bear law enforcement problems. Encourage covert operation if deemed necessary.
4. Provide 5,000 hours of law enforcement efforts to maintain a compliance index of 95%, while checking 2,600 bear hunters. Direct a minimum of 50% of this enforcement effort during the period of June through October to better address the problem of illegal closed season hunting. Special emphasis should be given to periods when the North Carolina bear season is open and Tennessee's bear season is closed.
5. Work with other agencies to secure private in-holdings within the Cherokee Wildlife Management Areas to address serious law enforcement problems caused by access to these lands.

V. Issue – Data collection methods to monitor bear populations are continually being improved.

Strategies

1. Investigate and develop additional methods to estimate and monitor bear populations.
2. Continue harvest data collection including tooth collections for age estimation.
3. Explore opportunities to determine the number of persons hunting bears in Tennessee.

VI. Problem – Demand for bear hunting opportunities causes conflicts among bear hunter groups, and between bear hunters and non-consumptive users of the bear resource.

Strategies

1. Managers will coordinate with I & E personnel to develop a pro-active I & E strategy that anticipates fluctuations in harvest and population trends and that can explain these issues to the public.
2. Design regulations to maintain an equal opportunity for all consumptive users of the bear resource (i.e. dog, gun and archery hunters).
3. Consider bear dog training seasons where not detrimental to the resource.
4. Counteract legislation that is detrimental to the bear resource.

VII. Problem – Because of shared bear populations among neighboring states, management practices in those states may be affecting Tennessee's bear population.

Strategies

1. Continue annual meetings between appropriate personnel from SABBSG for exchange information.

VIII. Problem – State and federal funds available for use are limited and in some cases declining; thus, accomplishments may be limited by funding restraints.

Strategies

1. Investigate changes in license structure/fees that will provide additional funding.
2. Seek partners among groups and municipalities for alternative funding for bear management.

Black Bear Strategic Plan 2006-2012 Committee Members:

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DATA SOURCES

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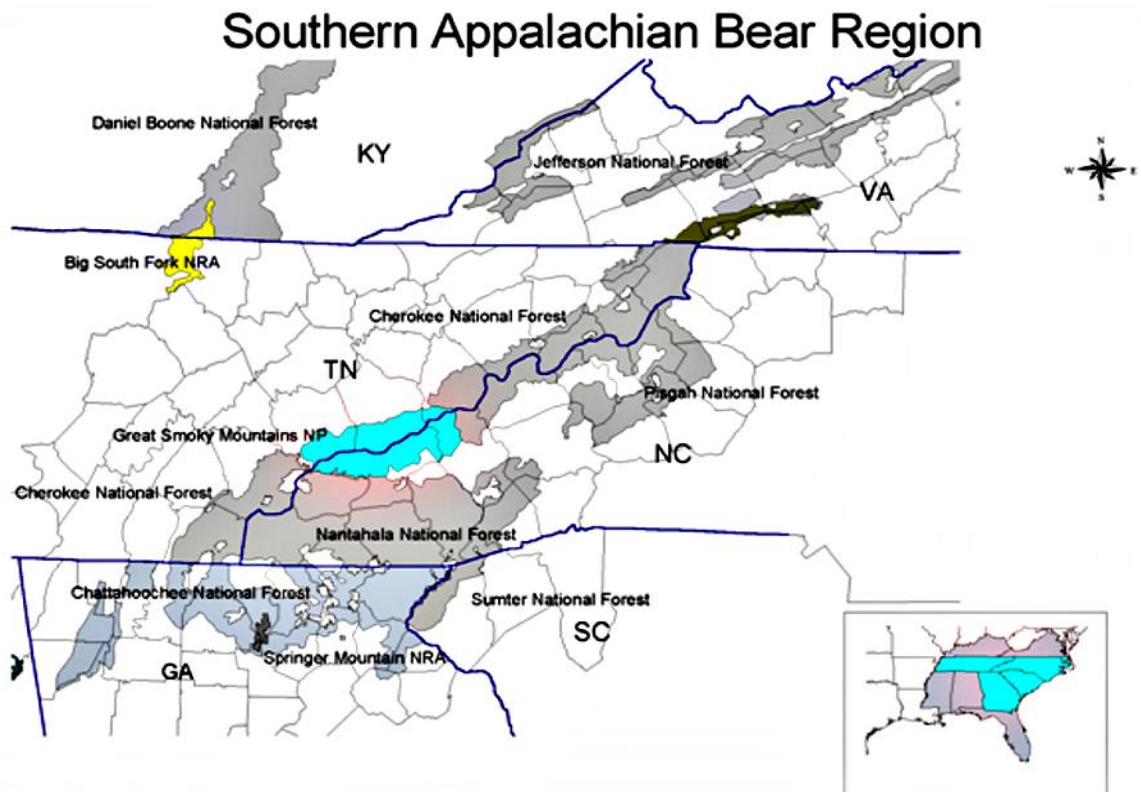


Figure. 1. The Southern Appalachian Black Bear Region.

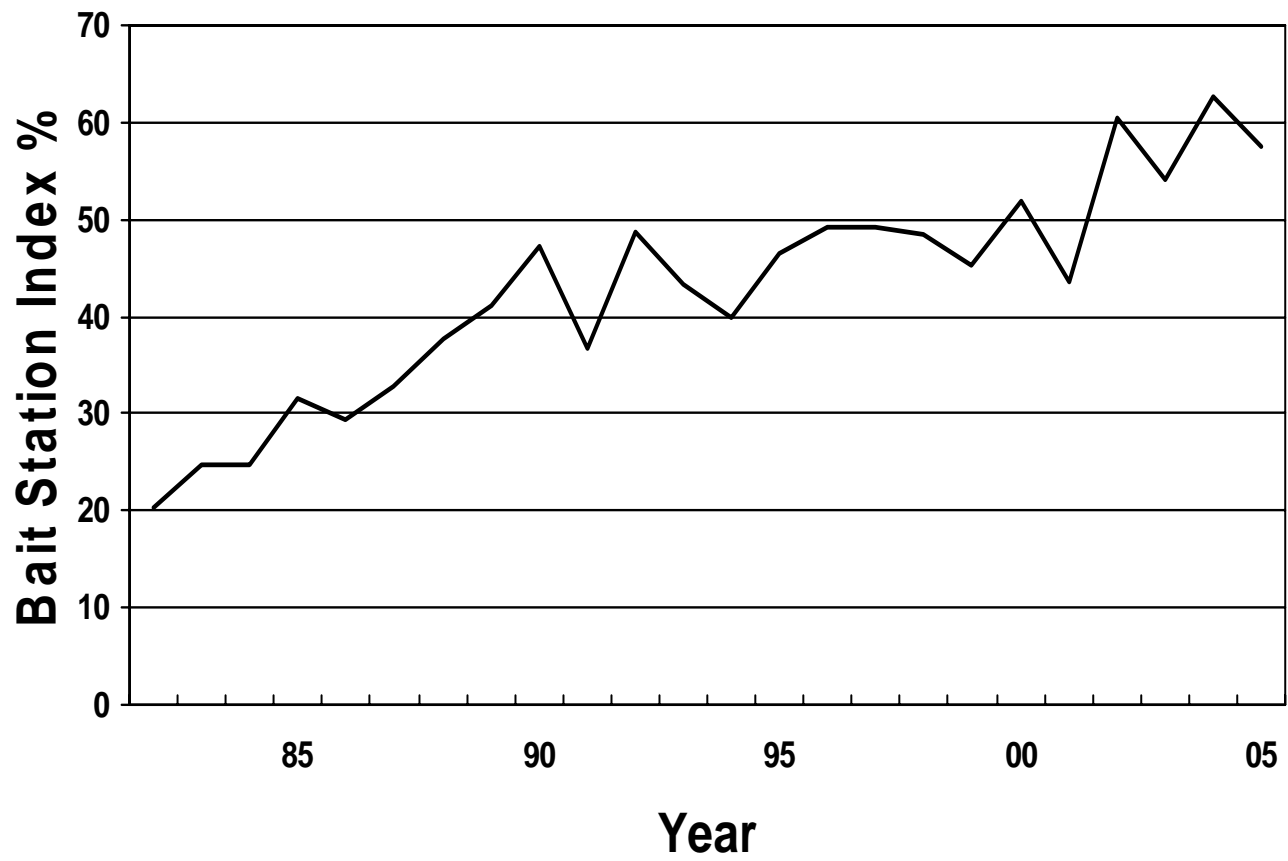


Figure 2. Black bear bait station surveys in Tennessee, 1982-2005.

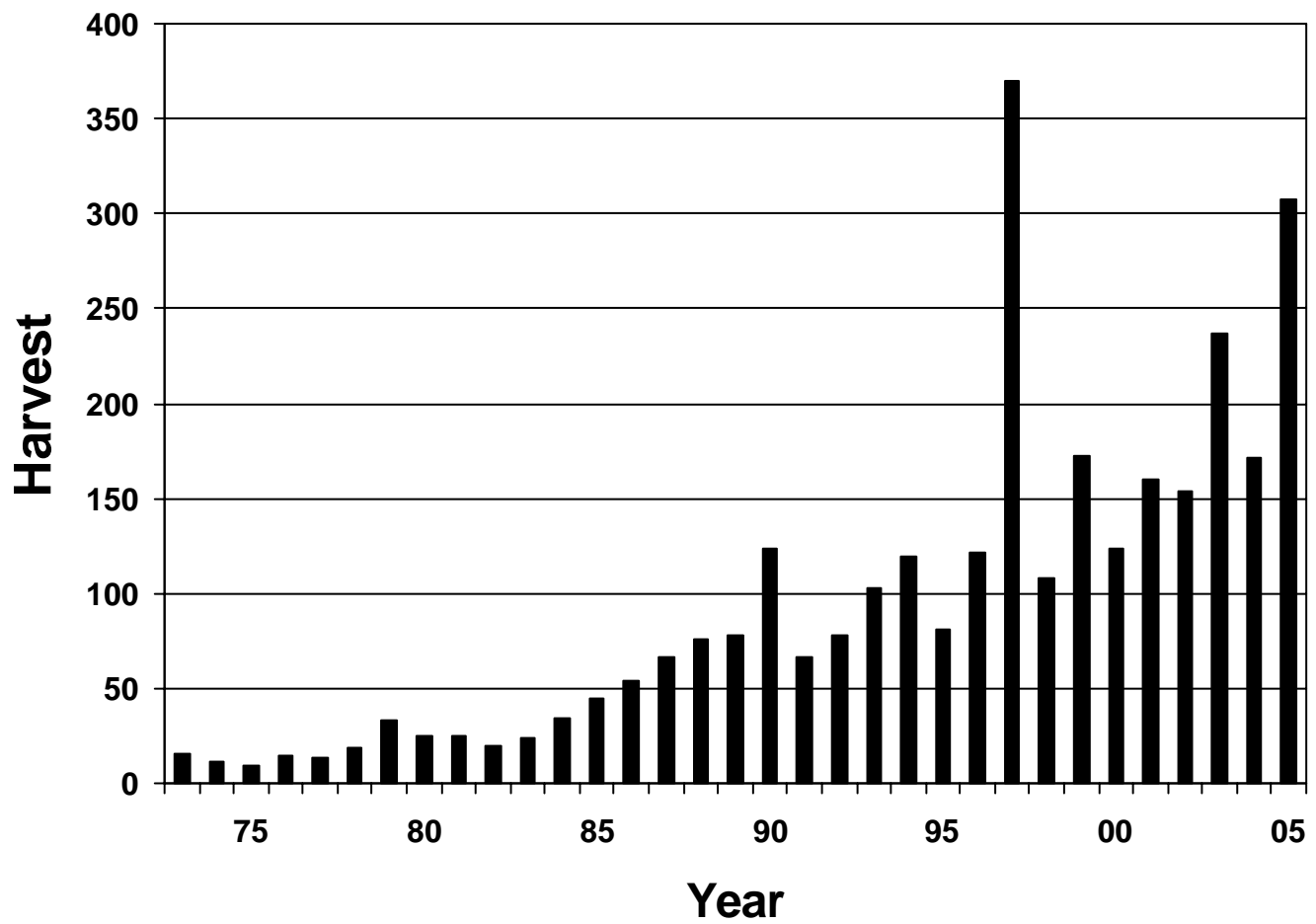


Figure 3. Black bear harvest in Tennessee, 1973-2005.

CURRENT AND PROJECTED STATUS

The wild boar (*Sus scrofa*) is well established on the Catoosa Wildlife Management Area (WMA) on the Cumberland Plateau which is State owned, and the South Cherokee WMA in Monroe, McMinn and Polk counties, which is owned by the U. S. Forest Service. Population densities are similar on the Catoosa and South Cherokee WMA's, averaging one wild boar to 300 acres. Wild boar populations on these two areas will continue to fluctuate with food supply availability (primarily hard mast crops). In addition, much smaller wild boar populations exist on Foothills WMA and Cove Mountain WMA. These two areas only contribute 2-5 boars to the annual harvest. Average wild boar harvest on these 4 WMA's is expected to remain near 240 boars per year (Figure 1).

Figure 1. Wild Boar Harvest (2000-2004)

WMA	2000	2001	2002	2003	2004	5 year avg.
Catoosa	96	77	81	97	72	85
Cove Mountain	0	0	2	0	0	<1
Foothills	9	4	1	4	0	3.6
South Cherokee	173	121	112	204	148	152
Totals	278	202	196	305	220	240

In the late 1970's, wild swine range expansions onto private lands that adjoined state WMA's began meeting with considerable public and political opposition due to the extensive crop and livestock depredation that occurred. Hunting season expansions occurred throughout the 1980's and 1990's to attempt to control the depredation. In the 1990's individuals began illegally releasing feral hogs on both public and private lands in the eastern two thirds of Tennessee. These releases have resulted in considerable depredation complaints. In 1998 the Tennessee Wildlife Resources Agency (TWRA) recommended, and the Tennessee Wildlife Resources Commission (TWRC) approved, new management objectives for wild swine in Tennessee. Wild swine on the Catoosa and South Cherokee WMA's were identified as "wild boar" and were to be managed as big game species at optimum levels. (Foothills and Cove Mountain WMA's have since been included as well). All wild swine outside these areas were identified as "feral hogs" and managed to control depredation. A year round season for feral hogs was established on private lands, and a season that coincided with any other open hunting season was established for wildlife management areas. Wild swine populations outside the Catoosa, Cove Mountain, Foothills, and South Cherokee WMA will decline or remain at low levels. These animals do not have to be checked out at a check station as required of other big game animals. Therefore, TWRA will not be able to determine the number of hunters, use days, or harvest.

PAST, PRESENT AND FUTURE USE

The wild boar was introduced into the southern Appalachian Mountains in the early 1900's from Europe. They escaped their initial hunting preserve enclosure in North Carolina, increased in numbers, and expanded their range to become part of the area's fauna. Wild boar was hunted for food and market along with the semi-domestic (feral) hogs who shared their range. With the establishment of the Tellico WMA in 1936, and the Great Smoky Mountains National Park in 1940, refuges were created which protected the wild boar from unrestricted hunting.

From the 1950's to the early 1970's boar hunting was primarily regimented still and dog hunting on the Tellico and Ocoee WMA's in eastern Tennessee. In 1965, wild-trapped boar was transplanted to the Catoosa WMA on the Cumberland Plateau (Conley, 1972). By 1971, wild boar was well established in the WMA. This population has expanded to include thirteen Cumberland Plateau counties. In the late 1970's wild boar were released on the Anderson Tully WMA in west Tennessee. While this population initially became well established, no documented harvest of wild boar has occurred in west Tennessee since 1994, so it appears the population no longer exists.

Wild Boars were established as a game species in the late 1940's with the establishment of the Tellico and Ocoee WMA's in Monroe and Polk counties. All hunts on these areas were highly regulated and required drawings. From 1950 to 1972 most of the boar harvest in Tennessee came from these two areas. Harvests ranged from 4 boars in 1962 to as many as 208 boars in 1968. In 1973, these two areas became part of the South Cherokee WMA. Many of the hunts on the area became non-quota at that time. The non-quota system has continued except for a few dog hunts in selected areas. Future harvest will depend on reproduction, which will in turn depend on environmental conditions affecting hard mast crops.

Hunter numbers have varied considerably during the 40 year history of the area. In the 1950's and 60's, the Tellico and Ocoee WMA's were some of the few places to hunt deer, bear or boar in Tennessee. The result was quota hunts had to be held, and hunter participation was high. The one to three day hunts were the only opportunity for a hunter to big game hunt for the year. Hunter numbers varied from 1100 in 1950 to a high of 6700 in 1968. Hunter use ranged from 2400 to 18,000 man days for the area (Conley, 1972). In the 1970's and through the 1990's, as non-quota hunts were added, and deer hunting expanded outside the WMA, hunter participation declined. As deer hunting continues to improve outside the WMA, participation will stabilize or possibly decline.

The Catoosa WMA was stocked with wild boar in mid 1960's. The first hunts were held for boar in 1969. A total of 9 boars were harvested. While most hunts on Catoosa were held in conjunction with deer hunts, a dog hunt was added in the 1990's. The average harvest for this time period was 40 boars. The last five year average has been 85 boars. In 1998, TWRA approved a change in deer management strategy for the area. The net

result of this change was to initially reduce hunter participation, and deer harvest was expected to decline under a “Quality Deer Management” program. As most boar hunting occurs along with deer hunting, boar harvest was also expected to decline. However, this was not the case. Average harvest increased from 49 (1995-99) to 85 (2000-04).

During the next 15 years, public interest and use of the boar resource is expected to increase. As hunter interest increases, the number of illegally stocked feral hogs can be expected to increase.

GOALS

1. Control feral hog populations in order to reduce depredation and nuisance complaints.
2. Manage wild boar populations at an optimum level on the Catoosa, South Cherokee, Cove Mountain, and Foothills Wildlife Management Areas.

OBJECTIVES

1. Reduce/eliminate feral hog complaints.
2. Maintain a minimum of 27,000 boar hunting trips by 9,500 boar hunters while maintaining a harvest of 200 boars on the Catoosa, South Cherokee, Cove Mountain, and Foothills Wildlife Management Areas.

OPPORTUNITIES, PROBLEMS, ISSUES, AND STRATEGIES

I. Problem: Established feral hog populations are increasing and expanding onto more private property and the Agency only has anecdotal data on where this is occurring

Strategies:

1. Continue liberalized feral hog hunting opportunities.
2. Evaluate hunter surveys as to their suitability to measure population numbers based on hunter observations.
3. Provide technical assistance to landowners regarding procedures to minimize crop damage.
4. Increase the issuance of depredation permits for feral hog damage.
5. Annually monitor feral hog depredation complaints and technical assistance.

II. Problem: Illegal stocking of feral hogs is occurring. This may contribute to introduction of swine diseases to wild boar populations.

Strategies:

1. Discourage illegal stocking by continuing liberal feral hog hunting opportunities.
2. Cooperate with USDA to enforce interstate swine transportation rules and regulations.

III. Problem: Hunters do not understand population dynamics and how hunting and weather affect populations.

Strategies:

1. Educate the public about wild boar population dynamics.
2. Educate public about how Jan./Feb. dog hunting can impact survival of young hogs.
3. Continue present and evaluate new surveys as to their suitability to measure population conditions and numbers.

IV. Problem: Natural food resources fluctuate due to variable weather conditions.

Strategies:

1. Evaluate management possibilities to provide alternate food sources.
2. Continue wildlife opening enhancement.
3. Continue annual surveys and investigate creation of new surveys to evaluate availability of food resources.

V. Problem: Illegal hunting has negative impacts on wild boar populations.

Strategies:

1. Enhance the cooperative law enforcement activities with the U.S. Forest Service and the U. S. Fish and Wildlife Service.
2. Provide 500 hours of law enforcement effort to affect 600 boar hunters while maintaining a 95% compliance index.

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COMMITTEE MEMBERS

Dan Gibbs (chair) - Region 4
Shelly Hammonds - Region 4
James Lane - Region 3
Ben Layton - Region 3
David Whitehead - Region 4

CURRENT AND PROJECTED STATUS

Tennessee has three major river systems (Mississippi, Tennessee, and Cumberland Rivers) which contribute to the 700,000 acres of impounded reservoirs and 19,000 miles of streams heavily utilized by residents, transient boats, and commercial vessels. Tennessee has about the same number of miles of navigable waterways as it does miles of interstate highways. In 2005 Tennessee had over 265,000 mechanically powered vessels registered, ranking it 18th in the nation and the 2nd highest of any non-coastal or Great Lake state in total boats registered. Approximately 300 marinas are located throughout the state's 38 major reservoirs.

The Tennessee Safe Boating Act of 1965 designates the Wildlife Resources Agency as the sole State agency charged with the responsibility of managing the State's boating program. The "Act" requires the TWRA to promote boating safety, achieve uniformity of laws and regulations with respect to the numbering and operation of recreational vessels, and foster the development, use, and enjoyment of the waters of Tennessee. These mandates are delivered through the five major program categories of administration, registration, enforcement, education, and facilities.

The staff components that shape and manage the program include the Boating Law Administrator and staff, the boat registration Supervisor and staff, and a State Boating Safety Coordinator. The program is implemented through "line" positions and the four Agency Regions which are organized under a Regional and Assistant Regional Managers. Each Region is staffed with a quarter-time Boating Safety coordinator who coordinates boating activities within the Region. The principal objectives of administration are to insure that the existing program is in substantial accord with the legislatively mandated objectives set forth in the Boating Safety Act, and to plan for the programs continued growth to meet the ever growing demands of the boater in Tennessee. Subordinate to these principal objectives is the implementation of a management system for boat acquisition and repair, the training of new boating officers, statute and regulation review and revision, policy generation and implementation, coordination of the statewide enforcement effort, accident and boating death investigation, and compiling boating statistics.

Registration of boats and the issuance of a certificate of number are accomplished at TWRA offices and numerous outside locations using automatic data transfer equipment. This Remote Easy Access License system (REAL) enables on demand renewal of boat registrations. The number of boats that are registered in Tennessee have increased from 241,632 in 1990, to 267,567 in 2005. The principal objective in this area is to complete the registration process accurately and in a timely fashion.

Enforcement of the "Act" is implemented in each Region through the efforts of Wildlife/Boating Officers and 63 part-time Boating Officers who routinely patrol most of the State's lakes and rivers. Limited numbers of local law enforcement officers are commissioned by the TWRA for the purpose of enforcing boating laws. The principal

objective is to insure compliance with the “Act” and those regulations issued by the Wildlife Resources Commission.

Ancillary objectives include the updating and procurement of boats and associated equipment, the expanding of patrol coverage areas, and investigative-procedures training for enforcement officers.

The boating program also includes the maintenance and construction of boating access areas, including ramps, parking areas, access roads, and docks for transient or non-trailerable boats. The engineering Division provides these services on an ongoing basis with facilities development authorized by the Executive Director and the Commission. This part of the program is operated by the Engineering Division, with two work crews dedicated to maintenance, renovation and development of these sites across the State. As of 2005 about 300 of these sites were being maintained.

Education of the boating public about safe boating practices, and a heightened awareness of safety and courtesy represent the primary objective of the education program. The Agency has one position dedicated to the coordination of boater education. The boating education coordinator is charged with developing a comprehensive statewide education program in addition to expanding the free-loan library, and increasing public awareness efforts in the media; this includes generation of news releases, radio spots, magazine articles, television spots, and news stories.

PAST USE

Tennessee’s waterways were once used as an important means of transportation by the State’s earliest residents. As trade developed, vessels of all description and size utilized the rivers as a means of commerce. As the need for flood control and guaranteed channels for commercial navigation increased, two major Federal Agencies became acutely involved in the management of the State’s river systems. The Tennessee Valley Authority and the U.S. Army Corps of Engineers impounded streams and guaranteed navigation on the Tennessee, Cumberland, and Mississippi Rivers. Several smaller tributaries were also dammed for flood control, recreation, and hydroelectric power generation. Recreational boating increased as the number of reservoirs increased and in 1965 the Tennessee Game and Fish Commission (now the Wildlife Resources Agency) was designated the sole State Agency charged with managing the State boating program. In that initial year there were 70,899 registered boats. A total of 13 accidents were reported including 6 injuries and 2 fatalities.

PRESENT USE

There are about 700,000 acres of surface water in Tennessee for boating recreation. Tennessee is among the Nation’s leaders in the number of major reservoirs with 38. The State has in excess of 17,000 miles of warm water streams and 2,000 miles of cold water streams. The opportunity for boating recreation is immediately available to the majority

of residents. There are more than 267,000 currently registered vessels in Tennessee and probably in excess of 30,000 boats that are not required to be registered. Tennessee's outdoor recreation survey indicated that 43% of the State's adult population participates annually in boating activities that are not related to hunting or fishing. When combined with trips for hunting, fishing and commercial navigation, this number becomes even greater. Boating fatalities represent the second leading cause of transportation-related deaths in the United States. Between 1965 (when the TWRA started keeping records) and 2005, nine hundred and forty-seven (947) Tennessee boaters lost their lives in boating accidents. Boating fatalities have been declining in the past few years; however accidents and injuries have not.

Primary safety problems continue to be the failure to wear life jackets, carelessness on the water and boating under the influence (BUI). Tennessee has a rigorous BUI law which includes severe penalties, a 0.10 percent blood alcohol limit, and an implied consent clause. The enforcement of this law and the public's knowledge of this law have contributed to a reduction in fatalities and accidents that are related to boating under the influence.

Funding for the program is derived primarily from boat numbering (registration) fees. Other income is generated from a small percentage of the tax on fuel used in boats, Federal assistance, fines, and the interest on the boating reserve fund. By law all boating and wildlife monies must be kept separately and may only be expended within their respective programs.

FUTURE USE

Over the past few years the number of registered vessels in Tennessee has increased with an estimated total registration of 300,000 by 2010. If this trend continues we can expect more crowding of Tennessee's reservoirs with the accompanying increase in boating accidents, injuries and fatalities. According to a University of Tennessee study (Fishing and Boating by Tennessee Residents in 1994, 1995, and 1996 Paul M. Jakus et.al.) 80% of boat owners support mandatory boating education, 46% indicated that law enforcement on the water should increase, and 58% support regulations on the discharge of waste to the water by boaters.

GOALS AND OBJECTIVES

GOAL:

Ensure that Tennessee waterways are safe and enjoyable for all users by providing a comprehensive program of education, law enforcement, and public access and facilities.

OBJECTIVES:

1. Continually provide a safe boating experience fostering relationships between partners, stakeholders and users to maintain the quality of service through enforcement, education, and outreach programs.
2. Enhance waterway usage through improved access and facilities.
3. Address ever increasing Tennessee waterway user demands on Agency resources, paying particular attention to trends in residential shoreline development, urban waterfront renewal, Tennessee's waterways as a vacation destination, and increased commercial traffic.
4. Enhance the effectiveness of boating programs by assessing human resources inside the TWRA as well as stakeholders.

PROBLEMS AND STRATEGIES

- I. Problem:** Reduce unsafe boating activity through an aggressive boating enforcement program.

Strategies:

1. Annually inspect a minimum of 45,000 boats per year.
2. Act as the lead agency in investigating all boating accidents involving a fatality or serious injury.
3. Maintain and enhance the level of boating related training to TWRA officers and personnel in other agencies with TWRA commissions.
4. Publish an annual analysis of boating accidents.
5. Explore the use of interstate compacts for boating violations.
6. Strengthen the memorandum of understanding with the U. S. Coast Guard.
7. Reduce fatalities to 4.5/100,000 boats.
8. Contribute to, and or develop a newsletter regarding HLS for appropriators (legislators, judges, etc)
9. Brief the TWR Commission as appropriate on matters related to TWRA's role in Homeland Security.

- II. Problem:** The TWRA has insufficient staffing to manage year-round boating activities.

Strategies

1. Produce an annual report of manpower requirements for marine special events, "off-season" boating, and education activities.

2. Develop SMAR code for special marine events to track manpower requirements.
3. Add an additional full-time boating officer position to each area as needed based on manpower demands for special events, “off-season” boating, and education.
4. Develop policies and procedures to establish a fee structure for marine special events that are conducted by a “for-profit” organizer.

III. Problem There is a need to ensure that education, media/outreach material and learning opportunities address current and emerging issues.

Strategies

1. Provide opportunity for mandatory boating education training and/or exams in each county once a month, at a minimum.
2. Enhance the rewards program to young boaters, by involving sponsors, in recognizing youth who exhibit safe boating practices.
3. Use all available media sources to provide timely information on boating safety (increasing PSAs to each region, use of billboards, media website, and shared TV time with partners)
4. Strengthen TWRA education/learning opportunities (make available all boating statistics, develop website, provide materials in different languages, and recognition of groups that promote safe boating)
5. Develop mini programs that address specific topics by using current data to determine what the emerging issues are and share with all groups.
6. Identify all partners and stakeholders, developing shared ideas to accomplish common goals or expand program.
7. Provide an avenue for new emerging user groups to voice boating concerns to TWRA
8. Maintain opportunity for training of all employees involved in boating.

III. Problem: There is a need to provide a clear enforcement role to stakeholders, partners, and the boating public.

Strategies

1. Identify all stakeholders and partners and engage them in providing a unified effort when approaching legislators regarding enforcement, legal, and funding issues.
2. Use media outlets (newspaper, TV, radio) to disseminate information about unique enforcement issues; specifically address causes of accidents and/or increased violations relating to safety on the water.
3. Annually review boating enforcement manpower to develop and implement additional officers and/or investigators due to emerging tasks placed on enforcement.
4. Annually review laws, proclamations, rules and regulations, policies and procedures. Place any additions, changes or deletions on the Agency’s legislative agenda for Commission review.
5. Conduct annual meeting to address enforcement equipment needs.

6. Maintain level of boat theft training.
7. Maintain and enhance automatic checks for boat registration that relates to stolen boats.
8. Recover a minimum of \$50,000 worth of stolen boats annually.

V. Problem: There is a lack of comprehensive analysis of data as it relates to shoreline development, use-density, current law enforcement actions, boat accidents, and zoning needs.

Strategies

1. Compile existing data from stakeholders over the past four years and correlate it with TWRA data (enforcement, education, etc.) to project anticipated TWRA needs based on existing studies related to the next five years.
2. Initiate a field order to identify existing access areas in the state and use the data collected to work with the Agency's Geographical Information System (GIS) section to produce a current map that projects an anticipated need for access areas and facilities.
3. Commission a statistical analysis of data compiled from the Tennessee Valley Authority, United States Army Corps of Engineers, municipal waterfront development offices, TN Marina Association and others to develop a comprehensive anticipated use projection relative to Tennessee waterway usage.
4. Beginning in 2008, use the data from strategy II to contract two new areas per year.
5. Beginning in 2008, use the data from strategy II for priority maintenance on the existing 200 plus ramps.
6. Maximize the use of CVA funding annually including funding of pumpouts, training events for marina owners, and continued publication of the Waterways Guide.
7. Utilize Tier 1 BIG Grants to fund a new or enhanced facility each year.
8. Identify all relevant stakeholders and strengthen relationships through increased communication.

VI. Problem: There is a need to conduct boating accident investigations and maintaining comprehensive boating accident policy within a changing legal environment.

Strategies

1. Finalize the Internet accident reporting system and match it with the Coast Guard BARD program.
2. Provide legislative package identifying laws (BUI and accident investigations) which need to be modified due to court trends or emerging issues.
3. Annually review all boating accidents, identifying trends, causes and other emerging issues from statistics, making available all boating accident statistics.
4. Maintain training level for accident investigations for Officers and Investigators.
5. Provide needed enforcement related equipment for accident investigation.

6. Identify and recognize the insurance industry as a needed partner in making waterways safer by reporting all boating accident claims.

VII. Problem: There should be a more active partnership between the TWRA user groups, stakeholders, and the tourism industry to advance our mutual goals.

Strategies

1. Identify key individuals or groups within each entity (stakeholders, user groups, tourism) (2007)
2. Identify shared agendas and objectives. (2007)
3. Develop agreements of shared action plans between entities. (2008)
4. Maintain contact through correspondence and one annual meeting to assess, evaluate and implement shared objectives

VIII. Problem: Increasing use of Tennessee waterways by non-resident boaters places a demand on manpower and facilities.

Strategies

1. Attempt to identify extent of non-resident use through data obtained from TWRA license sales, citation and accident reports, and information from the tourism industry.
2. Based on projected waterway usage analysis, initiate a needs study to analyze current staffing for the purpose of adding, reducing, or reassigning personnel.
3. Seek legislation to return or generate funding based on users.

BOATING STRATEGIC PLAN MEMBERS:

The Boating Strategic Plan was drafted by a cross-section of Agency employees who are directly involved in the Boating Program. The facilitator for the exercise was Jerry Kappel, a professional facilitator from Virginia who has helped with similar plans for the National Association of State Boating Law Administrators, the National Safe Boating Council, and the American Canoe Association. TWRA members were as follows: Darren Rider, Assistant Chief of Boating; Betsy Woods, Boating Education Coordinator; Ken Ripley, Boating Investigator; Glenn Moates, Boating Investigator, Ed Carter, Chief of Boating; Brian Ripley, Law Enforcement Supervisor for Area 41; Tim Sain, Law Enforcement Supervisor for Area 43; William Morris, Assistant Law Enforcement Supervisor for Area 12; Jeff Winfree, Region 2 Boating Coordinator; Matt Clarey, Region 3 Boating Coordinator; Ron Overbay, Region 4 Boating Coordinator; Ed Gover, Boating Officer, Area 21; Joe Busch, Boating Officer Area 33.

CURRENT AND PROJECTED STATUS

Recruitment rates into the commercial fishing industry are well below retirement rates from the industry so each year fewer commercial fishing licenses are sold. This can be attributed to the laborious and potentially dangerous nature of this occupation and the fact that most commercial fish species sell for virtually the same (less when adjusted for inflation) price today as they did 30 years ago. The availability of farm raised fish and the public's concerns over contaminants in wild fish are chiefly responsible for these market trends. Paddlefish and shovelnose sturgeon roe are the only products whose value has increased faster than inflation and their value is expected to increase further. Increased demand for paddlefish and sturgeon roe is alarming to many fisheries biologists in the U.S. because these species are prone to overfishing and stock collapse. These concerns regarding overfishing in roe fisheries and conflicts between commercial fishers and other user groups will likely be the principal issues for Tennessee's commercial fishing program to overcome during the 2006-2012 plan period.

PAST, PRESENT, AND FUTURE USE

Commercial fishing has been a way of life for some Tennesseans since the first settlements were established in the state. The Tennessee, Cumberland and Mississippi Rivers provided the resource which expanded with the reservoir construction boom. As late as the mid 1950's, Tennessee led 12 other states in the Mississippi River drainage in commercial fish harvest.

Management of Tennessee's commercial fisheries has been hampered by a lack of funding and personnel. Most of TWRA's commercial fisheries management has focused on the enactment and enforcement of regulations but occasionally studies are initiated to answer specific questions related to commercial fishing. For example, in the 50's and 60's several studies were conducted to evaluate commercial fishing gear (Hargis 1968) and explore the feasibility of rough fish removal via commercial fishing (Delaney 1960; Carrol et al. 1963). Periodically studies are conducted to assess the effects of commercial fishing on specific sport fish populations (i.e., Heitman and Van Den Avyle 1979). Kentucky reservoir has been the focus of numerous commercial fishing studies (Timmons et al. 1986; Bates 1990) and TWRA has surveyed the markets in this area since the late 80's (Conder 1988; Conder 1989; Conder and Broadbent 1990; Conder and Broadbent 1993; Conder and Broadbent 1994; Rider and Broadbent 1995; Broadbent, Rider and Wiggins 1996; Broadbent, Rider and Wiggins 1997; Rider and Wiggins 1998).

In 1990, an annual commercial fishing survey was conducted in January asking commercial fishers to provide recall information on their harvest for 1989 (Todd 1991). Later in 1990, a quarterly commercial fishing survey was instituted to shorten recall time and hopefully produce better harvest estimates. These quarterly commercial fishing surveys provided valuable information on commercial fisher demographics, waterbody use, gear use, harvest composition and harvest disposition (Todd 1993; Todd 1994a; Todd 1994b; Todd 1994c; Todd 1995; Todd 1996; Todd 1999a; Todd 1999b; Todd

1999c; Todd 2001; Todd 2002; Todd 2004). In 1993, TWRA began requiring monthly reports from all wholesale fish dealers which described their transactions with commercial fishers. Comparisons of harvest estimates from the wholesale fish dealer reports and the quarterly commercial fishing surveys indicated that harvest estimates from the quarterly commercial fishing surveys were not as accurate as expected. Consequently, in 2002 the quarterly commercial fishing survey was discontinued while a more accurate reporting system was designed. On July 1, 2005 the Daily Commercial Fishing Receipt was instituted to improve harvest estimates, obtain effort information, and to increase TWRA's ability to enforce commercial fishing regulations.

Over the next 15 years the public's use of Tennessee's commercial fishing resources is expected to gradually decline. Commercial fishing license sales have declined from a high of 3,090 in 1978 to 385 in 2004 (Figure 1). Since 1994, commercial fishing license sales have decreased at an approximate rate of 5% per year. Recruitment of new commercial fishers into the industry is slower than the rate of retirement from the industry. Over 54% of the commercial fishing license holders are older than 50 years of age and the decline in commercial fishing license sales is expected to continue as the average age of commercial fishers increases. Furthermore, a recent license fee increase is projected to result in an additional 12% reduction in 2006-2007 license sales. If current trends continue, license sales for 2012 will likely be less than 250 (Figure 2).

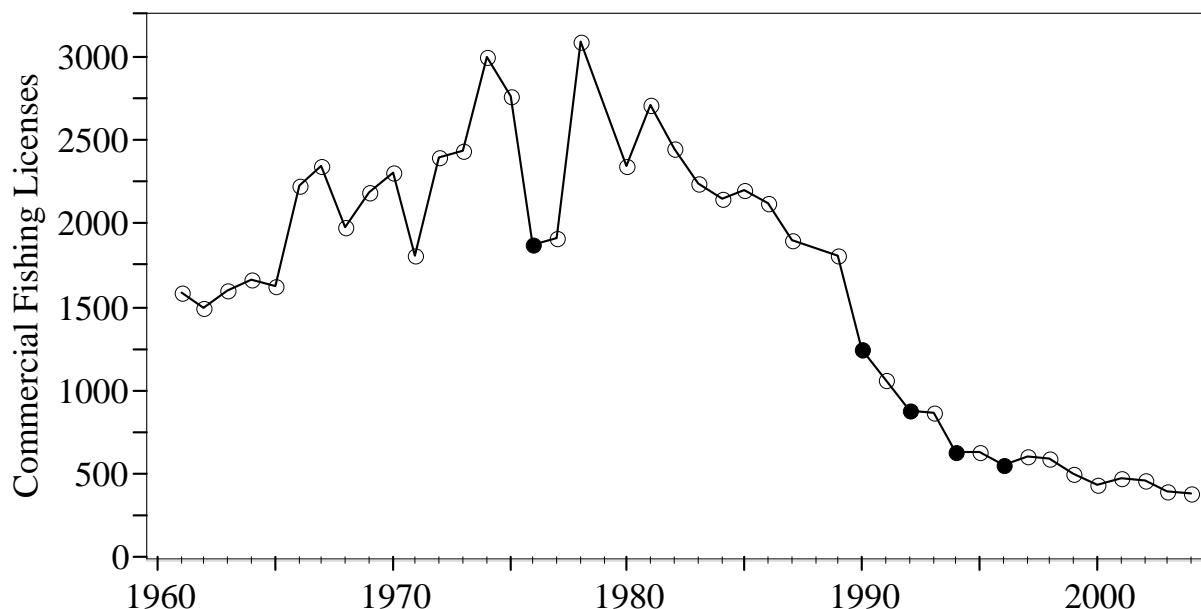


Figure 1. Commercial Fishing License (resident and non-resident) sales from 1961 to 2004. Solid circles represent license sales following previous license fee increases.

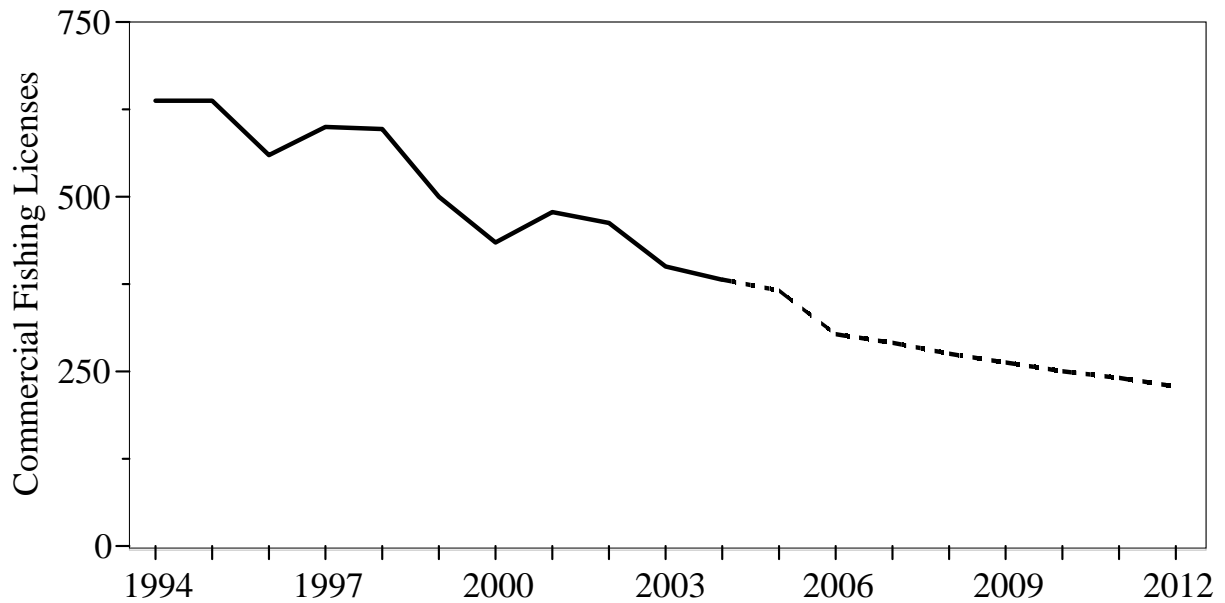


Figure 2. Commercial Fishing License (resident and non-resident) sales from 1994 to 2004 (solid line) and projected license sales for 2005 through 2012 (dashed line). Projected sales are based on the trend since 1994 (5% reduction in sales per year) and the expected effect of a license fee increase (12% reduction in 2006-2007 sales).

According to the quarterly surveys 88% of the commercial fishing license holders are part-time fishers. Many of these fishers do not sell their harvest and they only purchase a commercial fishing license so they can use commercial gear to harvest fish for their personal use or to give away. The other 12% of the license holders consider themselves full-time fishers and these fishers are likely responsible for most of the state's commercial harvest. For example, during a typical paddlefish season 23% of the paddlefish permit holders harvest 80% of the paddlefish. Additionally, over 86% of the annual commercial harvest is sold to a wholesale fish dealer, 4.8% is sold directly to a consumer, and 3.5% is sold to a grocery store or a restaurant. Only a small amount of the commercial harvest is kept for personal use (3.4%) or given away (2.2%).

Trotlines (38.5%), entanglement (gill or trammel) nets (34.8%), hoop nets (19.4%), and slat baskets (6.6%) are the most common gears used by commercial fishing license holders and a small percentage of fishers use seines, dip nets, cast nets, and turtle traps to harvest commercial species. Generally, full-time fishers utilize entanglement nets and hoop nets, whereas part-time fishers are more likely to use trotlines or slat baskets.

Over 434 thousand acres (72%) of Tennessee's major rivers and reservoirs are open to commercial fishing, including the Mississippi River, Reelfoot Lake, and 14 major reservoirs (Table 1). Additionally, there are 14 smaller river systems (Clinch, Duck, Emory, Forked Deer, French Broad, Hatchie, Hiwassee, Holston, Loosahatchie, Nolichucky, Obion, Wolf) which are open to commercial fishing. Normally less than 2%

of the annual commercial harvest originates from the smaller river systems and 45% of the total commercial harvest is from Kentucky Reservoir.

Table 1. Surface acreage of the major waterbodies which are open to commercial fishing and the proportion of the annual harvest which originates from these systems during an average season (based on Quarterly Commercial Fishing Surveys from 1994 to 2001).

Water Body	Acreage	% of Harvest
Kentucky	108,217	44.8%
Douglas	30,600	14.7%
Barkley	18,300	10.4%
Old Hickory	22,500	6.2%
Chickamauga	34,500	5.0%
Mississippi River	99,211	4.3%
Fort Loudoun	14,600	3.9%
Nickajack	10,370	2.1%
Cheatham	7,450	1.7%
Watts Bar	39,000	1.4%
Pickwick	6,159	1.3%
Guntersville	1,156	0.7%
Cherokee	30,300	0.6%
Reelfoot Lake	10,427	0.5%
Nolichucky	900	0.2%
John Sevier	786	< 0.1%
Total	434,476	

Twenty-eight percent of Tennessee's major water bodies are closed to commercial fishing for a variety of reasons. The Tennessee Department of Environment and Conservation, Division of Water Pollution Control recommended several of these closures because they issued consumption warnings for fish in these reservoirs. These warnings were issued because fish in these systems contain potentially hazardous contaminants. Several of the smaller reservoirs are closed to commercial fishing because commercial stocks are not large enough to support a sustained harvest. It is unlikely that these stocks will ever be large enough to sustain commercial harvest. Conflicts between commercial fishers and other user groups led to entanglement gear bans on some reservoirs and complete commercial fishing closure of other reservoirs. Unfortunately, further conflicts are anticipated because competition for Tennessee's resources will increase as the size and diversity of user groups increases. Under special conditions some of these water bodies could be utilized by the commercial fishing industry if the issues that prompted the closures were addressed.

Tennessee's commercial fishing industry has an estimated wholesale value of over \$2.7 million (Table 2). This estimate is based on typical rates that commercial fishers receive

from wholesale fish dealers for their harvest and it does not take into account the revenue generated from these products after the commercial fisher sells them. The primary commercial species are buffalo, catfish, paddlefish, and shovelnose sturgeon and products from these species generate over 98% of the estimated wholesale revenue for Tennessee's commercial fishing industry. Markets exist for bowfin, carpsucker, drum, gar, redhorse, suckers, yellow bass, and common snapping turtles but these markets are generally small, localized and easily glutted.

Table 2. Commercial harvest composition (proportion of total and poundage) for a typical year based on data from Quarterly Commercial Fishing Surveys from 1992 to 2001 and Monthly Paddlefish and Sturgeon reports from 1999 to 2005. The wholesale value of the harvest is based on 2005 market rates (prices paid to commercial fisher).

Species	% of Harvest	Harvest (pounds)		Wholesale	
				Price /lb	Total Value
Catfish	45.1%	2,217,617		\$0.45	\$997,927
Buffalo	35.2%	1,729,825		\$0.25	\$432,456
Paddlefish	2.8%	Flesh	140,583	\$0.45	\$1,185,928
		Eggs	17,272	\$65.00	
Shovelnose Sturgeon	< 0.1%	Eggs	741	\$65.00	\$48,137
Drum	11.0%	542,292		\$0.05	\$27,115
Carp	5.6%	275,794		\$0.05	\$13,790
Other	0.7%	33,054		\$0.05	\$1,653
					\$2,707,006

Commercial fishers are paid nearly the same price for catfish today as they were 30 years ago. After adjusting for inflation, it is evident that catfish prices have steadily decreased since the early 1970s (Figure 3). This decrease is attributed to an increased availability of farm raised catfish and the public's perceptions that farm raised catfish are of better quality. Prices are not expected to increase because currently there is an oversupply of domestically produced and imported catfish. Still it is unlikely that Tennessee's commercially harvested catfish market will disappear completely because many fishers are selling their products in small, localized markets.

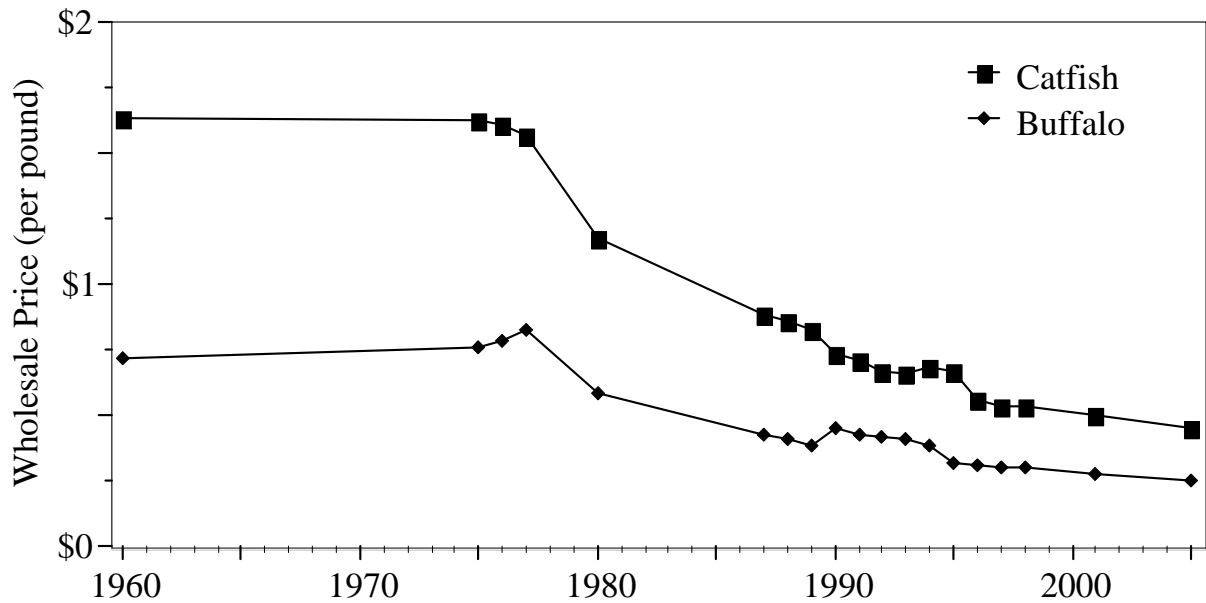


Figure 3. Inflation adjusted wholesale prices paid for catfish and buffalo since 1960. Prices were adjusted for inflation using an inflation calculator provided by the Bureau of Labor Statistics.

Similar to catfish, the prices paid for buffalo have not kept up with inflation. Buffalo are mostly marketed to large cities in the northern and eastern parts of the US. Although little growth is anticipated, this market should remain stable.

Since the early 1990s, Tennessee's paddlefish fisheries have received considerable attention because of the domestic and international trade in their caviar. Paddlefish exist in at least 22 states but Tennessee is one of only six states that allow commercial paddlefish harvest. Most states prohibit commercial paddlefish harvest because commercial overexploitation is thought to be responsible for many reduced paddlefish stocks throughout the US (Stockard 1907; Alexander 1914; Carroll et al. 1963; Alexander and McDonough 1983). Paddlefish are especially vulnerable to commercial overexploitation because they do not mature until later in life and they are very susceptible to entanglement gear. This vulnerability and the lucrative paddlefish caviar trade necessitate careful management of Tennessee's paddlefish fisheries.

A survey of commercial fisher's opinions regarding the management of Tennessee's paddlefish resource was solicited in 1991. Due to this survey and other information obtained, commercial fishing regulations regarding gear type and seasons were modified to reduce the harvest of this species. The TWRA continued to manage these fisheries by passing numerous regulations and because of limited funding these regulations were based largely on fishery dependent data. In 2002, the U.S. Fish and Wildlife Service funded a paddlefish study on Kentucky Lake because their Office of Scientific Authority was concerned about the number of permit request they were receiving for paddlefish

caviar which originated from this system. This study provided the funds necessary to collect fishery independent data and to conduct a thorough survey of Kentucky Lake's commercial paddlefish fishery. This study and concurrent surveys conducted by TWRA indicted that despite TWRA's efforts to regulate paddlefish harvest, Kentucky Lake's paddlefish stock was being fished at unsustainable rates. In July of 2005, TWRA again recommended further regulation changes based on the results of the Kentucky Lake paddlefish study.

Paddlefish are the most strictly regulated commercial species in Tennessee; nevertheless Tennessee's paddlefish fisheries are essential to the commercial fishing industry. For example, during the 2004-2005 paddlefish season (which was considered an average season) commercial fishers reported that 7,343 paddlefish were harvested statewide. Over 51% of these fish had eggs and the total reported egg harvest was 17,915 pounds. At \$65 per pound, the wholesale value of the 2004-2005 paddlefish harvest was \$1,164,452. In July of 2005, retail values for paddlefish caviar ranged from \$10.95 to \$24.00 per ounce and at the average rate of \$17.82 the 2004-2005 harvest was worth over \$5 million retail. Additionally, some wholesale fish dealers purchase paddlefish flesh and the 2004-2005 paddlefish harvest yielded an estimated 109,713 pounds of dressed paddlefish. At \$0.45 per pound the wholesale value of this flesh was worth \$49,371; however, many commercial fishers do not sell paddlefish flesh because they harvest paddlefish solely for the roe.

The shovelnose sturgeon fishery in the Mississippi River is small but important to Tennessee's commercial fishing industry. Shovelnose sturgeon exhibits many of the same vulnerabilities as paddlefish which is why this fishery has become the focus of an interstate management effort. Illinois, Kentucky, Missouri, and Tennessee are working to standardize their management and enforcement efforts for sturgeon on the Mississippi River. This cooperation is expected to continue and it may expand to other species in the future. In Tennessee, commercial fishers reported a harvest of 1,313 shovelnose sturgeons from the Mississippi River during the 2004-2005 season and the average harvest for the past 5 seasons was 1,358 fish per season. The total reported egg harvest was 716 pounds and at \$65 per pound, the wholesale value of the 2004-2005 paddlefish harvest was \$46,540. At this time there is not a market for sturgeon flesh in Tennessee, although smoked flesh markets exist in other states.

The prices paid for paddlefish and sturgeon roe have increased substantially since the mid-1970s and this trend is expected to continue. The increasing national and international demand for Tennessee's paddlefish and sturgeon caviar is associated with decreasing supplies of other, higher quality caviar. Several Eurasian stocks of sturgeon (*Huso huso*, *Acipenser* spp.) have collapsed and the fate of others is unknown. Consequently, many consumers are turning to the US as there source for caviar. This increased demand will require continued monitoring and management of Tennessee's roe fisheries to prevent their collapse.

GOAL:

To identify the available resource and manage commercial fisheries for an optimum sustainable yield that provides for multiple uses.

OBJECTIVE:

Develop and implement long-term management plans for four commercial species by 2012, starting with those species for which there is increased local, national, or international concern. Species management plans should identify methods, systems, and management techniques to maintain an optimum sustainable harvest of commercial fish from public waters.

OPPORTUNITIES, PROBLEMS, ISSUES, AND STRATEGIES:

- I. Issue** – Periodic stock evaluations and routine harvest monitoring are necessary to determine the optimum sustainable yield for each fishery so informed management decision can be made.

Strategies

1. Concentrate available resources on commercial species for which there is local, state, or national concern to provide the necessary biological information to implement management strategies to insure self-sustaining stocks for commercial harvest.
2. Require all commercial fishers and wholesale fish dealers to provide accurate harvest information through reports to the Tennessee Wildlife Resources Agency.

- II. Issue** – Current implementation of penalties for commercial fishing violations is insufficient to deter illegal activity and enforcement of these laws and regulations is necessary to protect the commercial resource for the benefit of the public.

Strategies

1. Increase training for wildlife officers to detect commercial fishing violations and activities.
2. Develop a system to monitor compliance with commercial fishing regulations during this plan period and implement techniques to improve compliance if necessary.

- III. Issue** – The commercial fishing industry and TWRA have inadvertently assumed adversarial roles and this contentious relationship often jeopardizes the management and sustainability of Tennessee's commercial fisheries.

Strategies

1. Use successful commercial fisheries as models to establish a management approach that involves professional commercial fishers in the management of Tennessee's commercial fisheries by 2008.
2. Explore methods for commercial fishers and wholesale fish dealers to select a small group of representative (about 7 in total from the four regions) who can sufficiently express their interests and concerns to the TWRA and TWRC.
3. Periodically meet with representatives from the commercial fishing industry to discuss management and enforcement needs for Tennessee's commercial fisheries.

IV. Issue – Many of Tennessee's commercial fisheries require coordinated interstate management and enforcement efforts.

Strategies

1. Standardize regulations and management techniques with border states so interstate commercial fisheries can be managed and enforced more efficiently.
2. Attend regional and national meetings where commercial fisheries management and enforcement are discussed.

V. Issue – Bycatch in commercial gear can cause conflicts with sport fishers and can make management efforts counter productive.

Strategies

1. Work with the commercial fishing industry to identify and promote commercial fishing techniques that reduce bycatch encounter and mortality rates.
2. Explore methods to differentiate full-time, professional commercial fishers from "non-income" commercial fishers and confine non-income fishers to gears, seasons, and areas with little bycatch.
3. When necessary implement regulations to minimize bycatch encounter rates and maintain bycatch mortality rates below 20%.

VI. Issue – There are many false perceptions about commercial fishing which cause conflicts between sport and commercial fisheries and there is a general lack of awareness concerning Tennessee's commercial fishing industry.

Strategies

1. Incorporate information about Tennessee's commercial fishing industry into educational presentations during this plan period.

VII. Issue – There is inadequate identification and protection of critical habitats (i.e., spawning and nursery areas) and flow regimes for commercial species to maintain self-sustaining populations.

Strategies

1. Identify critical habitats and flow regimes for commercial species by 2012.

2. Develop a Geographical Information System database of critical habitats for commercial species and distribute this information to appropriate agencies and TWRA divisions.
3. Protect, restore, and improve critical habitats and flow regimes when necessary.

VIII. Issue – Public health risk and the ecological consequences of degraded water quality in the aquatic environment directly affects all aspects of commercial fishing.

Strategies

1. Continue participation in the interagency “Valley Wide Contaminants in Fish” project.
2. Insure public health by coordinating enforcement and monitoring activities with other agencies and organizations to reduce contaminant levels and insure compliance with state and federal water quality law.

IX. Issue – Periodic review of commercial laws and regulations is necessary to manage the commercial resources in a manner to attain program objectives

Strategies

1. Conduct an annual review of commercial fishing laws and regulations to determine if changes are necessary to attain program objectives
2. Recommend law and regulation changes to the Legislature and Tennessee Wildlife Resources Commission when necessary to attain program objectives.

X. Issue – Funds generated by the commercial fishing program are not sufficient to fund the existing program nor fund a more fully managed program

Strategies

1. Seek additional funding for the commercial fishing program by 2012.
2. Explore methods to maximize available funds and resources.

METHODS

This strategic plan for the Commercial Fisheries Program was developed by the Commercial Fisheries Program’s Strategic Planning Committee. All committee members were either law enforcement officers or resource managers selected by their Division Chief or Regional Manager. Committee members were selected based on their knowledge of commercial fishing industry.

The committee met from 9:00 to 3:30 on Tuesday, May 3, 2005 in the main conference room in the Nashville office. In the morning the committee drafted a goal and objective for the commercial fisheries program and issues (problems and opportunities) were brain

stormed. After lunch the committee prioritized the issues and brainstormed strategies to address each issue. Additional brainstorming exercises were conducted via email to insure that all issues and strategies were identified. The chairman modified the plan based on committee comments from these exercises and the committee reviewed the changes.

Copies of the draft plan were available for public review on November 17 – December 19, 2005. Comments were solicited through statewide news releases in order to determine the public's opinions on the plan. Public comments were incorporated into the plan where appropriate.

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CURRENT AND PROJECTED STATUS

Tennessee's commercial mussel industry experienced a market "boom" during 1990 to 1995, which was followed by a decline during the period 1996 to 1998. These market fluctuations were caused by many competing factors including: increased demand driven by threats to the U.S. mussel shell supply caused by the invasion of the zebra mussel, improving and declining economies, influx of cheaper Chinese freshwater cultured pearls, and die-offs of Japanese pearl culture oysters which resulted in decreased demand for U.S. shell products. Over the five-year period of 2000 to 2004, 5,565 tons (11,130,000 lb) of mussels were harvested from Tennessee waters, with an estimated wholesale value of \$8,760,620. More recently, (2003 to 2005) market demand and corresponding annual commercial mussel shell harvest totals have stabilized near 1,300 tons/year.

Tennessee's quality commercial mussel stocks are primarily limited to Kentucky Reservoir. Kentucky Reservoir stretches 184.3 miles from Pickwick Dam at Tennessee River mile (TRM) 206.7 in Hardin County, TN to Kentucky Dam at TRM 22.4 in Kentucky. The Tennessee portion contains 1,971 shoreline miles and approximately 110,990 surface acres, ending at TRM 49.2 in Stewart County, TN. Reduced harvest pressure has allowed the commercial resource to increase the percentage of legal-sized mussels in the Kentucky Reservoir population, which routinely comprises > 90% of Tennessee's mussel harvest tonnage (Hubbs, 2005). Kentucky Reservoir population assessments conducted between 2000 and 2005 revealed good recruitment of most commercial mussel species. This portion of the Tennessee River system should continue to produce the World's highest quality pearl nuclei material (D. Hall, TN, Shell Co., pers. comm., 2005). Surveys conducted during this same period on the Cumberland River revealed a lack of substantial mussel reproduction except in Barkley Reservoir. The mussel populations of the Cumberland River upstream of Cheatham Dam are impacted by cold water releases from U. S. Army Corps of Engineers operated dams. Surveys of the upper Tennessee River reservoirs (Chickamauga, Watts Bar, and Fort Loudon) also exhibited mussel populations suffering from recruitment failure due to indeterminate factors. These populations exhibit sparse evidence of recent recruitment, and are in need of more extensive management techniques to alleviate their current condition.

The majority of the mussel harvest comes from the Kentucky Reservoir portion of the Tennessee River (99.6%) (Hubbs, 2005). Ninety-seven percent of the harvest is divided among seven species, with the Ebony Shell (*Fusconaia ebena*) routinely comprising approximately 60% of the annual harvest tonnage followed by the lake mix group (Threeridge *Amblema plicata*, Mapleleaf *Quadrula quadrula*, Southern Mapleleaf *Q. apiculata*, and Lake Pigtoe *Fusconaia flava*) at 30%, and Washboards (*Megaloniais nervosa*) at 5% and Pink heelsplitters (*Potamilus alatus*) at 2%. These species have adapted to the existing environmental conditions associated with impoundment and invaded the over bank areas of Kentucky Reservoir. There is evidence of good recruitment in Kentucky Reservoir. Decreased harvest efforts have allowed over-harvested shell populations to begin recovering, as evidenced by the increased percentage of above legal sized mussels in the population (Hubbs, 2005).

A recent analysis of Kentucky Reservoir's harvest data and size distribution by species group showed 67% by weight of the Ebonys were between 2 3/8" and 2 1/2", compared to 33% at 2 5/8" and larger (Hubbs, 2005). The lake mix group continued to benefit from reduced harvest pressure, with the weight of 2 3/4" shells exceeding the 2 5/8" by 16%. Lake Grade Washboards were almost entirely made up of 4.0" shells (3% by weight) with only 29 pounds of 5.0" (0.03%), and 0.1% as ≥ 4.0 " river grade. The market for colored shells (pinks) produced 1.33% by weight and 3.77% by value of the harvest. Mussel shells imported from other states equaled 79,688 pounds, and comprised 3.0% of the total Tennessee market.

PAST, PRESENT, AND FUTURE USE

Freshwater mussels have provided an essential environmental element to Tennessee streams and a source of food and trade items for people for thousands of years (D. H. Stansbery, OSUM, pers. comm., 1987). The first freshwater mussel shell button company was founded by John F. Boepple in 1891 at Muscatine, Iowa. The shell button industry flourished throughout the Mississippi River basin as a multi-million dollar business for approximately 50 years. However, shell buttons were replaced with the advent of cheaper plastic buttons by the 1960s.

The Japanese invented the modern pearl culture industry which requires a nucleus cut and formed from a shell bead. This nucleus is surgically implanted into an oyster or mussel where the animal covers it with layers of nacre. The cultured pearl industry grew in the 1990's with annual U. S. retail sales of \$700 million, and world wide sales totaling \$3 billion. The commercial mussel shell industry experienced a peak in harvest pressure in 1995. During this year, there were 1,397 licensed harvesters that collected an estimated 3,881 tons valued at \$14,731,777. The market peak was followed by a rapid decline to 600 tons taken by only 351 harvesters by 1998. Historically low wholesale prices have kept commercial shell harvester license sales below 500/year since 1997. Estimated total wholesale shell harvest value ranged from \$2.4 million to \$0.66 million during 2000 to 2005. Slowly, the market began a modest recovery after 1998, and is expected to stay near the average of approximately 1,300 tons per year (Wm. Salyers, pers. comm., 2005) recorded during the period 2000 to 2005, 2004's harvest totaled 1,267 tons wholesale valued at \$1.4 million. Increased prices attracted additional harvesters, the number of licensed harvesters increased from 215 in 2003 to 247 in 2004. The average income per harvester decreased from \$7,122 to \$5,740 per harvester. These shifts in species and sizes of commercial shell landings were attributed to altered market demand. Weighted average wholesale price paid to harvesters (\$0.56/lb in 2004) remained near the historic low.

Less than one percent of the harvest came from the Cumberland River system during 2004. There is meager evidence of mussel reproduction in the Cumberland River upstream of Nashville (D. Hubbs, pers. obs., 2003). Cold water releases from reservoirs appear to be limiting mussel recruitment. Under the current circumstances, this fauna exists only as a terminal population and should be protected against extinction until such

time that conditions improve and reproduction resumes and a surplus of commercial mussel species is documented.

Commercial shell exporters estimated that mussels taken from Tennessee would continue to dominate the entire United States harvest. According to Olson (2002) approximately 96% of the shells exported from the United States were harvested in Tennessee. Annual U. S. shell exports are expected to remain between 2,000 to 3,000 tons over the next five years (B. Ballenger, Aubri Shell Co., pers. comm., 2005) and Tennessee's shell production is anticipated to remain between 1000 and 2000 tons over the next fifteen years (N. Arnold, Tennessee Shell Co., pers. comm., 2005). However, the Japanese pearl culturing oyster die-offs that began in 1996 have resulted in fewer pearl farms in Japan and reduced demand for U.S. shell products. Market competition from China, which continues to export large quantities of non-nucleated cultured freshwater pearls, will continue to suppress U.S. shell futures unless China increases its use of U.S. shells in nucleated pearl production. The problems facing the pearl culture industry are expected to continue to affect U.S. shell exports for at least five more years. This modest market should provide more opportunity for the commercial mussel resources in Kentucky Reservoir to continue to improve both in abundance and size class distribution.

Any person, firm or corporation who purchases or otherwise obtains freshwater mussels taken from Tennessee waters is required to pay the Tennessee Wildlife Resources Agency the amount equal to \$0.0145 per pound of mussel shells or \$0.0124 per pound of mussel (shell with meat) purchased or obtained. Monies generated from the shell fee are earmarked for the management (75%) and enforcement (25%) of the commercial mussel resource. The current fee rate is the same as when it was first levied in July 1991. The 2004 harvest totaled 1,267 tons valued at \$1.4 million and the shell fee produced \$31,786 in revenue. Tennessee's commercial mussel industry harvested 23,129 tons (46,258,000 lb) of mussel shells with an estimated wholesale value of \$54,524,707 from Tennessee waters during the period 1992-2004. (Note: the export value is conservatively estimated to be three to five times higher than the wholesale value, at \$163,574,120 to \$272,623,540 million; there are instances where the mark up is 7 to 12 times the wholesale value). During the same period, TWRA received \$1,166,915 from commercial mussel license sales and \$608,762 from the fee on mussel shells, representing 3.25% of the wholesale value. From these figures, it is evident that there is sufficient value in the commercial mussel resource to provide improved funding for its management and protection. As the shell industry has experienced a drastic decline in the number of harvester licenses sold (average 288/year during 2000 to 2004), and an annual harvest averaging approximately 1,300 tons over the last five years, the only viable way to make the program financially solvent would involve an increase in the shell fee. With current harvest and license trends the shell fee would need to be set at \$0.10 /lb (to generate ~\$250,000) along with a \$500 resident harvester license (generate \$145,000) (total \$395,000) to get close to balancing the current indirect program cost of ~\$430,000/year.

Parmalee and Bogan (1998) identified 129 species and 26 subspecies of freshwater mussels from Tennessee waters, 10 of which are designated as legal for commercial harvest. This is one of the greatest mussel assemblages in the World. The full economic

and environmental importance of these different mussel species have yet to be developed or understood, therefore every effort should be made to protect and properly manage them and their habitat so that they will be available to future generations.

GOALS

The goals of the commercial mussel program are to insure the conservation and management of commercial mussel species, and protection of their habitats;

To: increase and properly utilize the surplus populations of commercial mussel species.

To: improve communication between the Agency and the commercial industry.

OBJECTIVES

1. Manage the commercial mussel fishery to maintain/increase recruitment of commercial mussel populations and size class distributions where $\geq 15\%$ of each commercial species is above its minimum legal size limit.
2. Monitor population levels in the primary fisheries on the Tennessee and Cumberland River systems.

OPPORTUNITIES, PROBLEMS, ISSUES, AND STRATEGIES

- I. Problem** - Current information is required to manage the commercial mussel fishery, which is vulnerable to over-harvest during periods of high market demand.

Strategies

1. Conduct ten (10) mussel population assessments annually on the most frequently fished waters; determine relative abundance, diversity, and size distribution, in harvested and unharvested areas between the periods 2006 to 2011.
2. Continue to refine the mussel buyer/harvester automated electronic data capture reporting system. This system should be designed to speed the availability and increase the accuracy of data used to determine the annual mussel shell harvest and monthly collection of shell fees.
3. Continue to evaluate and adjust the size of non-harvest areas to make them more effective as breeding areas, refuges for endangered species, and for comparative population studies. Protect populations such as those found in the Cumberland River above Cheatham Dam, which can not sustain commercial exploitation.

II. Problem - Violations of TWRA laws and regulations prevent accomplishments of program objectives.

Strategies

1. Enforce compliance with minimum harvest size regulations of commercial mussel species. Perform three details per year checking at least fifty percent of the harvesters.
2. Enforce compliance with mussel buyer receipt regulations to better document extent of commercial harvest. Perform three details per year checking each buyer at least once each year.
3. Enact new and/or change regulatory restrictions when and where necessary.

III. Problem - The effect of specific pollutants, combinations of pollutants or pollutant degradation products on the aquatic environment continues to threaten commercial mussel resources and requires further investigation.

Strategies

1. Enforce existing pollution laws; improve coordination of enforcement and monitoring activity with regulatory agencies, conservation groups, the media, and public interest groups.
2. Mussels are excellent indicators of environmental degradation and water quality. Continue financial support through grants to researchers to further development of standardized bioassay methodology to determine the response of mussels to contaminants; conduct one major freshwater mussel research effort each year as funding permits.
3. Explore alternative low cost measures to provide development of qualitative and quantitative methodology for analysis of non-point source related pesticides in mussel flesh and mussel bed substrate.
4. Because major commercial and sport fish species feed on mussels; continue to conduct basic descriptive investigations to qualify and quantify contaminants in mussel flesh and mussel bed substrate; conduct analysis of mussel flesh for two (2) species at five (5) sites annually.

IV. Problem – Commercial mussel communities are threatened by habitat destruction.

Strategies

1. Require site specific mussel surveys prior to consideration of modification of Tennessee River and tributary sand and gravel dredging permits or any other activities that disturb aquatic habitat.
2. Vigorously oppose issuance or re-issue of sand and gravel dredging permits which threaten mussel and host fish habitat.
3. Provide documentation of noncompliance with sand and gravel permit restrictions to regulatory agencies.
4. Promote mussel restoration projects including restoration of substrate, water quality, and fisheries.

V. Issue - State funds available for use are limited and in some cases declining, thus, accomplishments may be limited by funding restraints.

Strategies

1. Continue to request an increase in the commercial mussel shell fee to offset revenue lost from decreased harvester license sales.
2. Increase licenses rates as needed to adequately fund the management of the commercial resource.

VI. Problem - Aquatic nuisance species are a major threat to Tennessee's commercial mussel populations.

Strategies

1. Participate in the development of Tennessee's Aquatic Nuisance Species Management Plan.
2. Cooperate with the Tennessee Valley Authority, U. S. Army Corps of Engineers and other partners to monitor and manage aquatic nuisance species as they relate to commercial mussel resources in Tennessee.
3. Inform the public about the potential harmful impacts of aquatic nuisance species and present methods to prevent their introduction and spread.

VII. Problem - The public is not aware of the commercial mussel resource in Tennessee or its economic value.

Strategies

1. Present three (3) youth oriented programs per year emphasizing the role of freshwater mussels as environmental indicators, techniques for their conservation, and their commercial value during 2006 - 2012.
2. Produce and distribute annual resource inventory and industry status reports.
3. Produce and distribute summaries of commercial mussel harvesting regulations.

METHODS

The commercial mussel fishery will continue to fluctuate according to market demand. In order to provide an improved resource for the fishery, it is necessary to manage the harvest where $\geq 15\%$ of the commercial populations is above legal size limits. This level was derived from commercial mussel harvest data and population trend assessments performed yearly since 1992 and are expected to allow the mussel populations to maintain sufficient recruitment into the fishery (Hubbs, 2004). Adequate recruitment is essential to provide a variety of size classes that will increase the marketability of the resource. Increased size classes should result in better average incomes for the harvesters.

The commercial mussel industry's needs and uses were calculated based on information obtained during interviews of commercial mussel shell exporters, wholesale mussel dealers and harvesters. Interviews were conducted by the mussel program coordinator and commercial enforcement officer. Tennessee is expected to provide > 90% of the total U.S. harvest during the next five years. The annual export of U.S. mussel shell is expected to remain near the previous five year average. However, annual harvest totals are subject to dramatic fluctuations caused by industry purchasing practices, specific shell grade availability, and perceived threats to the resource.

The freshwater mussel strategic planning committee used the 2000 Strategic Plan along with data collected by the statewide mussel program coordinator and regional aquatic habitat protection biologists to construct the 2006 strategic plan. The chairman and members met, reviewed the 2000 plan and made changes where required to meet future Agency goals and improve the mussel fishery.

The chairman included the changes into a draft of the Commercial Mussel strategic plan. Copies of this draft were provided to the committee members for review and additional comments. Additional changes were incorporated in subsequent drafts and the final plan was then submitted to the Tennessee Wildlife Resources Agency Planning Office.

The freshwater mussel strategic planning committee composed of : chairman mussel program coordinator Don Hubbs, statewide commercial enforcement officer Freddy Couch, region I wildlife officer Alan Jones, and region II aquatic habitat protection biologist David Sims; used the 2000 Strategic Plan along with data collected by the statewide mussel program coordinator and regional aquatic habitat protection biologists to construct the 2006 strategic plan. The chairman and members met, reviewed the 2000 plan and made changes where required to meet future Agency goals and improve the mussel fishery.

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CURRENT AND PROJECTED STATUS

The state has in excess of 99,000 acres of pond and small lake habitat, which accounts for nearly half of the fishing trips made in Tennessee annually (Jakus, et.al. 1999). Some of the reasons for this popularity are that these habitats are more easily managed, highly productive and can offer an angling experience not offered by large reservoirs. The Community Fisheries Program was developed to provide fisheries management and fishing opportunities on ponds and small lakes (up to 600 acres) in Tennessee.

Experienced anglers find ponds and small lakes to be an excellent hideaway from the congestion and interference from other recreational users, such as pleasure boaters and skiers. Also, when these impoundments are available close to home they provide greater opportunities to the angling public. Many anglers' first fishing experience is from the bank of a pond or small lake, and is often the stepping stone for Tennessee youngsters who later become dedicated anglers, environmentalists and conservationists. Ponds and small lakes can produce some of the best fishing for largemouth bass, bluegill, catfish and redear sunfish in the state. These waters currently account for 11 state record fish in Tennessee.

Prior to the 1930's, nearly all ponds and small lakes were used for agricultural purposes and fire control. During the depression the trend began to change. The drought of the 1930's led to the Soil Conservation Service (presently Natural Resources Conservation Service) farm pond building program in the United States (Flickinger, et.al. 1999). The demands for protein and inexpensive recreation during World War II intensified the interest in pond construction and management.

Accompanying the increase in recreational interest was an increase in research applied to the fisheries of small impoundments. Little was known about the management of a pond or small lake for fishing, such as species, numbers and size of fish to stock, harvest rates, and other related practices necessary to maintain a sustainable fishery. With increased research through the 1940's, 50's and 60's, reliable information was generated on these small impoundments capable of producing higher populations of game fish than could normally be found in most rivers, streams, and reservoirs. Later research dealt with the propagation of sunfish hybrids, the use of white amur for aquatic vegetation control, and producing trophy fisheries (i.e. Florida largemouth bass).

The interest in farm fish ponds really started growing with the organization of Soil Conservation Districts within the state in 1950. From 1949 to 1955, over 15,000 new ponds were constructed in Tennessee, and by 1960 there were more than 25,000 ponds and small lakes in the state. Currently, Tennessee has an estimated 198,500 ponds and small lakes, averaging about one-half acre each, for a total of 99,250 acres (Tim Cross, UT Extension Service, personal communication). The western portion of the state with its fairly flat topography is ideally suited for these impoundments and Region I accounts for 45 to 50% of the state total. Region II (Middle TN) accounts for 25 to 30 % and Region III (Cumberland Plateau) for 10 to 15%. Region IV (East TN), an area known for large reservoirs, accounts for 5 to 10%.

Most Agency managed lakes were originally constructed during the 1950's in areas deficient in public fishing opportunities, such as reservoirs. For this reason, most of these lakes are located in western and middle Tennessee. Several of these lakes were also

turned over to TWRA in the early 1930's by other conservation organizations such as the Civilian Conservation Corps. Two lakes have been constructed since 1990 and four lakes were donated to the Agency in 1995 by Occidental Chemical Company.

The Agency now owns and manages eighteen public fishing lakes, and several Wildlife Management Areas have several ponds and small lakes which allow for a variety of management options such as youth (16 years of age or younger) fishing. These eighteen lakes are stocked primarily with largemouth bass, bluegill, and channel catfish. In recent years (mid 1990 to present) some of these lakes have been stocked with crappie, redear sunfish, blue catfish, and Florida largemouth bass. These fishing lakes range in size from 13 to 560 acres, and total 2,950 acres. Ten of these lakes are located in Region I, and eight in Region II (Figure 1). Four youth fishing ponds/small lakes are located in Regions II and III.

The productivity in terms of total pounds of fish per acre varies from lake to lake, depending on whether or not the lakes are supplementally fertilized and on nutrient input from the watershed. Fishing pressure also varies from lake to lake; however the fishing pressure per acre on these managed lakes is generally higher than pressure on Tennessee reservoirs. Average trips per acre on Agency managed lakes in 2004 were 55, while trips on reservoirs were 4 per acre (TWRA, Malvestuto, et.al. 2004). Due to the high amount of fishing pressure on these lakes, they are intensively managed for fishing. These management techniques include fertilization, harvest restrictions, supplemental fish stocking, creel surveys, population surveys, habitat improvement, and population control to reduce competitive and/or overcrowded species of fish. There is a small charge for a daily (or annual) fishing permit on most of these lakes to help defray management costs. Other benefits derived from TWRA Agency Lakes include picnicking, camping, wildlife observation, silt and floodwater control, and other outdoor related activities such as rifle and/or archery ranges, hunting, nature trails and horseback riding around some Agency lakes.

In an effort to provide quality fishing, the agency provides fisheries technical assistance to pond and small lake owners dealing with species balance, water quality, aquatic vegetation control, fish kills and stockings. This includes cooperating with the Department of Environment and Conservation, Division of State Parks to provide assistance and limited fish stockings on several of the State Parks' 25 ponds and small lakes. These twenty-five small impoundments are located in seventeen state parks and provide 2,265 acres of fishing opportunity.

The agency continues to develop partnerships with city and county governments or other agencies to develop or enhance urban/suburban fishing opportunities within their communities (community fishing). Twenty-two community fishing locations, consisting of approximately 335 acres have received Agency assistance as of 2004. Eleven were stocked with either channel catfish, largemouth bass, bluegill or trout. There are opportunities to expand this assistance to other municipalities, particularly at those locations having existing small impoundments. Agency personnel can capitalize on these opportunities by contacting municipalities to find out their desire to accept assistance from TWRA in developing or enhancing fishing opportunities for their communities. As

with most activities, manpower and funding will dictate how much assistance can be provided by the Agency.

PAST, PRESENT, AND FUTURE USE

Fishing trips to Agency lakes fluctuated between the years 2000 and 2004 (Figure 2), with an average of 175,200 trips per year (TWRA 2000-2004). This is relatively the same as the 1994-1998 average of 171,000 trips, but considerably less than the 2000-2005 objective of 297,000 trips (TWRA 2000). Part of this is attributed to Gibson County Lake not coming on line until the 2003 fishing season, and averaging only 24,000 trips since then. The 297,000 objective was based on the lake opening in 2001 with an initial 35,000 trips. Fishing pressure ranged from 19 trips per acre on Whiteville Lake to 140 trips per acre on Herb Parsons Lake during 2004 (TWRA).

For Agency lakes, an objective of 200,000 fishing trips annually by 2011 was set by the committee. This represents approximately a 12% increase from the 2000-2004 average of 175,200 trips. If this increase is successful, the Agency will need to stay aware of possible overcrowding issues that may occur. To meet this increase, Agency personnel will need to continue with maintaining adequate access and high quality fishing through intensive fishery management techniques.

Although the majority of ponds and small lakes are located on private land and provide limited access to the general public, these waters provided fishing opportunities to an estimated 340,000 to 530,000 anglers annually from 2000 to 2004 (Figure 3), (UT Human Dimensions Laboratory, unpublished data). Total trips made to these impoundments ranged from an estimated 3.4 to 5.3 million annually, with trips per angler varying from 6 to 15. Estimates for the 1994-1998 period ranged from 4.11 to 4.70 million trips annually (Jakus, et.al., 1998, 1999). An estimated 59% of the state's angler population reported fishing at least once in these impoundments between March 1 and August 31, 2003 (UT, unpublished data).

With the extreme fluctuation in the number of anglers and trips to these non-Agency waters, it's difficult to predict future participation rates. The committee used an average of 10 trips per angler per year, and set an objective of 5 million trips by 500,000 anglers for 2011 (Figure 3). This is approximately a 9 % increase from an average of 454,500 anglers and 4,545,000 trips for 2000-2004. Ponds and small lakes in Tennessee are estimated to increase by approximately 0.5 percent per year through 2012 (Table 1). The percentage of the anglers in Tennessee that fish these small impoundments is expected to remain stable over this same period of time.

Except for those which may be included in the UT surveys, no current data is available on angler use at state park ponds and small lakes. However, the fishing opportunities these impoundments (2,265 acres) provide are an asset to the angling public. These parks would likely be ideal locations to implement programs such as a fishing tackle loaner program and fishing/aquatic education classes/activities.

Fishing opportunities in small impoundments can be affected by a lack of fish for stocking. In some years, TWRA's current hatchery production is only adequate to supply

requested species for reservoirs, much less Agency lakes. The fish needed to stock these lakes, State Park and city lakes, youth fishing events, and the development of more urban/suburban fisheries will increase the demand on our present hatcheries. Based on estimates by fisheries biologists working on these waters/events, the Agency could use approximately 1.3 million catfish, 750,000 bluegill/redear sunfish, 200,000 largemouth bass, 170,000 trout, and 15,000 grass carp within the next 3 to 5 years. Other species that will be stocked include crappie and Cherokee bass.

Several TWRA warmwater hatcheries have received renovations since 2002, which included new ponds, pond liners, and raceways. While the renovations caused some “downtime” at the hatcheries, only a limited amount of increased fish production has occurred, and much of this went to meet stocking allocations in reservoirs. Renovations are ongoing as funds are procured, and once completed an increase in production is expected. In order to increase stockings, particularly catfish and trout, into small impoundments, and for kids fishing events, the Agency will need to continue to maximize production where possible, and expand where feasible. Without additional increases in production, especially for catfish and trout, it is likely some stocking projects will not be accomplished. Even with the Agency now charging a nominal fee for private fish stockings (largemouth bass and bluegill), this has reduced the demand on hatcheries only slightly. To help meet demand, the Agency purchased approximately 111,300 pounds of catfish (\$158,900) in 2003 through 2004, for stocking youth fishing events and Agency lakes.

As long as access to ponds and small lakes are made available to the public, we expect to see an increase in fishing participation at these impoundments during the next 15 years. However, as mentioned previously, the majority of these impoundments are located on private property, thereby limiting access to the general public. Changing demographics, including an increase in urban/suburban residents and less leisure time will also have an affect on participation rates which is shown in national surveys. For example, fewer youths are being recruited into recreational fishing and older individuals are dropping out (Fedler, et.al. 1998), and fishing participation as a whole has leveled off (Responsive Management 1999). So as the existing anglers leave recreational fishing, fewer individuals are going to replace them. In an effort to change this, the Recreational Boating and Fishing Foundation has recently implemented a national “Take Me Fishing” campaign to introduce more youth and women to fishing, and bring former anglers back into recreational fishing.

While 38 % of Tennessee residents listed fishing as their most popular outdoor recreational activity (Responsive Management, 2005), fishing participation in the state has remained relatively flat for the past decade, while decreasing in many other states (USFWS, 2001). Since the future of fishing depends on the recruitment and retention of anglers, it will be important for TWRA to continue management efforts and expand or implement programs to recruit and retain anglers. While new Agency owned lakes are unlikely to be constructed in the near future, maintaining and improving existing ponds and small lakes, providing fisheries technical assistance and fish stockings will help increase the potential for additional fishing opportunities. Increasing awareness of and access to small impoundments, along with holding youth/adult fishing events/activities, and expanding current fisheries outreach programs will be needed. The Agency will also

need to assist cities, counties and other agencies to provide close to home fishing opportunities in urban/suburban areas, where the majority of the state's population resides.

The Agency should consider implementing a fishing tackle loaner program, increasing fishing/aquatic education classes, and developing a fisheries marketing program to recruit and retain anglers. It would be important to gather information as to why certain groups in Tennessee are not fishing, and what we can do to get them into recreational angling. The Agency may also want to explore the possibility of restructuring its licenses by offering a "family" license, a "one-year" license, a "group" license, or a fishing "only" license. An annual "collectors' series" type license could be offered, in an effort to get non-consumptive users to support the Agency's mission.

One could ask if state fish and wildlife agencies should be in the business of retaining and recruiting anglers. One reason it should at least be part of agencies' business is the fact that fishing license sales are a principle source of funding for fisheries conservation efforts. Also, anglers have historically been the outspoken proponents for aquatic habitat protection programs and contribute to fisheries management and conserving aquatic resources through excise taxes on fishing equipment and motor boat fuel that fund the Federal Aid in Sport Fish Restoration Program (Wallop-Breaux).

For the recruitment and retention of anglers as a whole, there is a need for major information and education on such things as the why, where and how to fish, along with outreach, and promotion/marketing efforts on the benefits and value of recreational fishing (Responsive Management 1999, 2003). Besides the fun of catching fish, putting food on the table and an outdoor activity that can be enjoyed with families and friends, fishing allows for exercise, stress release, relaxation, and experiencing nature.

GOAL

To manage for and provide quality angling opportunities, and increase fishing participation throughout the state.

OBJECTIVES

By 2011:

- 1) Increase fishing trips on ponds/small lakes to 5.0 million by 500,000 anglers.
- 2) On 18 Agency lakes, increase fishing trips to 200,000.
- 3) Maintain 22 existing community fishing sites (municipal ponds/lakes), and develop 4 new sites per region.
- 4) Conduct a minimum of 8 partnership projects that enhance access (e.g. piers/platforms) at municipal fishing sites. (Projects would use matching funds or labor from city/county government agency or other organizations.)

OPPORTUNITIES, PROBLEMS, ISSUES AND STRATEGIES

I. Problem - An insufficient number of ponds/small lakes, along with a lack of access, limit fishing opportunities for the public.

Strategies:

1. Continue to operate a minimum of 18 Agency lakes, and make necessary improvements to maintain facilities and access.
2. Continue to work with city/county governments to increase/enhance the number of municipal fishing sites, in order to provide “close to home” fishing opportunities.
3. Continue to identify and update TWRA, TDEC, TVA, COE, and USFWS land holdings that can be used for angler access to ponds/small lakes and publicize by available I&E outlets.
4. Continue, and where possible, expand opportunities for seasonal type fisheries (i.e. trout, catfish).
5. Investigate and where feasible, acquire or lease available fishing sites as opportunities occur.
6. Expand the number of youth and/or youth-parent fishing areas.
7. Explore the possibility of establishing a private lands incentive program (e.g. tax incentives) to encourage voluntary property access for fishing purposes.
8. Explore the possibility of holding youth and family fishing events at newly expanded Agency hatcheries.
9. Publicize the appropriate way for anglers to ask for access to private fishing waters.

II. Problem - There is a lack of public awareness of existing pond/small lake fishing opportunities.

Strategies:

1. Increase public knowledge about fishing opportunities by way of all media outlets and outdoor related venues (e.g. news releases, PSA's, TV, brochures, Wildlife Magazine, other outdoor magazines, billboards, license agents, utility bill mailings, email newsletter, Internet, tourist agencies, libraries, Chambers of Commerce, welcome centers, camp stores, fairs, outdoor/fishing shows).
2. Develop, implement and evaluate a marketing strategy to increase awareness of fishing opportunities.
3. Continue to identify ponds/small lakes, particularly those on TWRA controlled lands open to public fishing, and publicize through all I&E outlets.
4. Maintain and improve directional signage to TWRA fishing facilities, and coordinate with TDOT and/or the legislature to allow the placement of Agency fishing facility signage along interstates.
5. Work with city/county governments to place necessary signage at municipal fishing sites.

6. Optimize the use of the National Fishing Week/Tennessee Free Fishing Day campaign to make the public aware of fishing opportunities.

III. Issue - There is a need to recruit new anglers and retain current anglers.

Strategies:

1. Increase/expand the Agency's fisheries outreach programs statewide (i.e. BOW, SMART, Kids Fishing Derby's) and develop new ones to recruit/retain (e.g. Rod/Reel loaner program, fishing/aquatics education program- "TennAqua," Take a Mom Fishing, mentoring programs, DVD/video and materials about fishing methods, tackle needs, etc.). Programs should consider diverse population demographics (e.g. age, gender, ethnicity, physically-challenged).
2. Develop, implement and evaluate a marketing/public relations strategy to increase recruitment and retention with an emphasis on urban/suburban areas.
3. Provide training and dedicate man-days for Agency personnel for fisheries outreach.
4. Survey the public for opinions, motivations, values and characteristics to help the Agency focus its outreach programs, while considering population demographics (e.g. age, gender, ethnicity, physically-challenged).
5. Expose more schools to the Agency's fisheries outreach programs and materials.
6. Cooperate with necessary groups and agencies to introduce them to the Agency's fisheries outreach programs, and partner with organizations, businesses, fishing clubs, and interested individuals to expand the outreach potential.
7. Enhance/expand the Agency's web site related to fisheries outreach, incorporate interactive activities, and link to other acceptable subject related web sites.

IV. Issue - To ensure proper management and provide quality fishing, data must be collected, and assistance provided to evaluate and monitor pond/small lake fisheries.

Strategies:

1. Continue to collect fish population, habitat and angler use data on TWRA Agency lakes, and necessary data on watershed lakes and WMA ponds.
2. Cooperate with other government agencies to conduct necessary data collection on ponds/small lakes.
3. Conduct statewide surveys to gather information on public use, fishing success and fishing expenditures on ponds/small lakes.
4. Promote the use of interns/part-time personnel to assist with necessary data collection.
5. Provide fisheries technical assistance and management materials to pond/small lake owners.
6. Conduct appropriate research projects (i.e. Florida LMB).

V. Problem - Demands for fish stockings into ponds/small lakes exceed hatchery supply.

Strategies:

1. Operate hatcheries for maximum production. (To provide bass, bluegill, redear sunfish, catfish and crappie for stocking Agency Lakes, WMA ponds and newly constructed/renovated ponds/small lakes)
2. Expand hatchery production to provide fish for program projects. (To provide bass, bluegill, catfish, trout, grass carp for stocking newly acquired/enhanced community fishing sites, State Park Lakes, watershed lakes, youth fishing events and seasonal fisheries.)
3. When feasible, purchase needed fish for stocking or exchange/trade with other fish hatcheries.
4. Maintain a list of commercial hatcheries to make available to pond/small lake owners who request fish suppliers, and make this available on the Internet.

VI. Issue - State and federal funds are limited and may decline; thus, accomplishments and manpower may be limited by budget constraints.

Strategies:

1. Develop support for a percentage of the sales tax to help fund fish and wildlife projects.
2. Develop partnerships with other groups, corporations and private companies for accomplishment of work on municipal fishing sites and for fisheries outreach projects.
3. Increase the Agency's use of volunteers/interns, while tracking volunteer time to use for "in-kind" services for matching any federal funds.
4. Seek sponsorships to help defray cost of specific projects/events.
5. Increase use of fisheries staff to work on municipal fishing sites, for necessary data collection, and for fisheries outreach.
6. Where feasible, continue with concessionaire operations at Agency lakes, or utilize honor system.
7. Evaluate and/or pursue:
 - a. The development of a fisheries stamp series, similar to the wildlife stamps.
 - b. Increasing the number/types of conservation license plates sold.
 - c. Having an option for voluntary contribution of refunds to TWRA if a payroll tax is eventually implemented.
 - d. The use of donation boxes at TWRA facilities, offices and venues.

VII. Issue - Non-compliance with TWRA laws and regulations negatively impacts the resource and results in a loss of revenue.

Strategies:

1. Utilize appropriate law enforcement effort to maintain a compliance index of 95% on ponds/small lakes.
2. Simplify regulations where possible.

3. Evaluate the number of catch-out fishing operations and commercial hatcheries statewide for license compliance.
4. Evaluate and pursue increasing fines for fisheries/wildlife violations.

METHODS

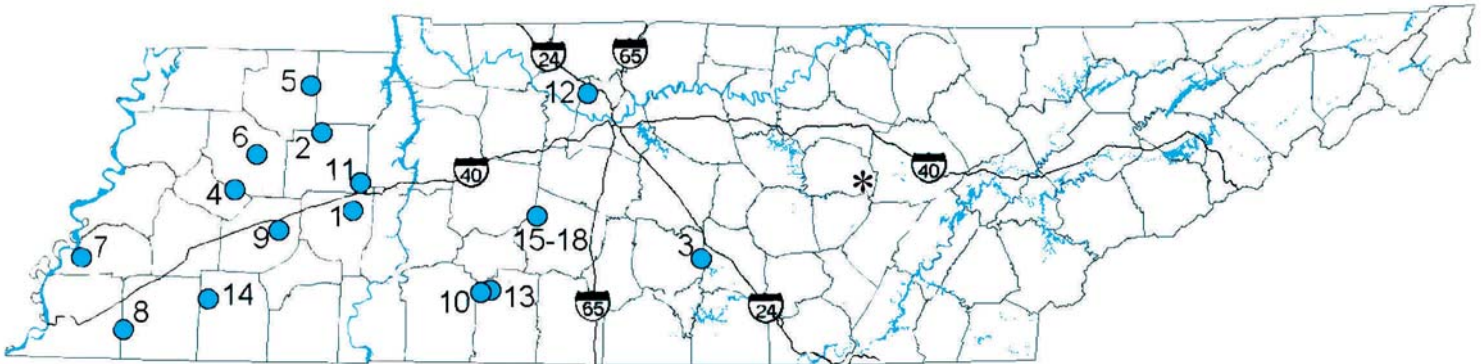
This program plan was developed by the Community Fisheries Planning Committee, which consisted of the following TWRA staff familiar with biological, law enforcement, educational and administration issues concerning ponds and small lakes fisheries: Mike Bramlett, Chuck Casey, Tony Cross, Eric Ganus (recorder 1st meeting), John Hammonds, Bryan Kegley, Patricia Miller, Jereme Odom, Jim Pipas, Dave Rizzuto, and Jack Swearingen. The Tennessee Department of Environment and Conservation was contacted with an invitation to send a representative to serve on the committee, but no one attended. Committee meetings were held in Nashville on May 5 and July 27, 2005.

The committee used “brainstorming” techniques, as instructed by the USFWS’s Management Assistance Team, to develop and organize the goal, objectives, problems/issues and strategies. After the goal was formulated the members discussed the baseline performance as it related to “where are we now?” Data collected by creel surveys, permit sales reports and the University of Tennessee’s annual survey of anglers was used for review. Problems/issues and strategies were discussed and scored by individual committee members then ranked in priority. Decisions were made by informed consent and committee vote.

Further review and possible revisions were made by TWRA’s directors and staff members.

Progress toward achieving the plan objectives will be measured by creel surveys, permit sales, concessionaire information, and statewide angler surveys. Reporting from various Agency Divisions, such as Information and Education, Law Enforcement and Planning will also be used in the final accomplishment report.

Copies of the draft plan were made available for public review November 18th – December 18th, 2005. Statewide news releases and other TWRA media outlets were also used to solicit the public’s suggestions and comments on the plan.

Figure 1. TWRA Agency Lakes

1. **Brown's Creek Lake (Henderson County) 167 acres**
 2. **Carroll Lake (Carroll County) 100 acres**
 3. **Coy Gaither/Bedford Lake (Bedford County) 47 acres**
 4. **Davy Crockett Lake (Crockett County) 87 acres**
 5. **Garrett Lake (Weakley County) 183 acres**
 6. **Gibson County Lake (Gibson County) 560 acres**
 7. **Glenn Springs Lake (Tipton County) 310 acres**
 8. **Herb Parsons Lake (Fayette County) 177 acres**
 9. **Lake Graham (Madison County) 500 acres**
 10. **Laurel Hill Lake (Lawrence County) 325 acres**
 11. **Maples Creek Lake (Carroll County) 90 acres**
 12. **Marrowbone Lake (Davidson County) 60 acres**
 13. **VFW Lake (Lawrence County) 22 acres**
 14. **Whiteville Lake (Hardeman County) 158 acres**
 - 15-18. **Williamsport Lakes (Maury County) 164 acres**
 Whippoorwill - 25 acres
 Blue Cat - 80 acres
 Goldeneye - 13 acres
 Shellcracker - 46 acres
- * Bridgestone/Firestone WMA Youth Fishing Ponds (White County) 15 acres**

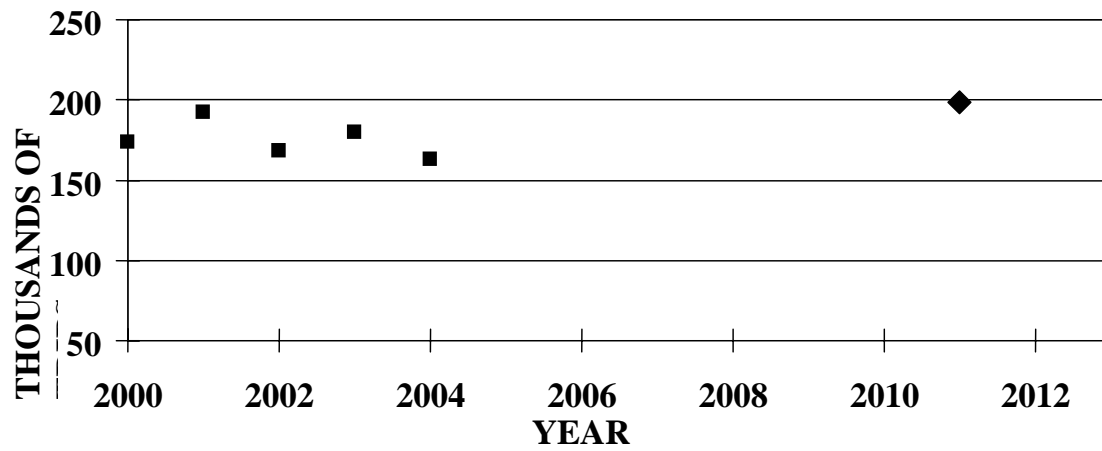
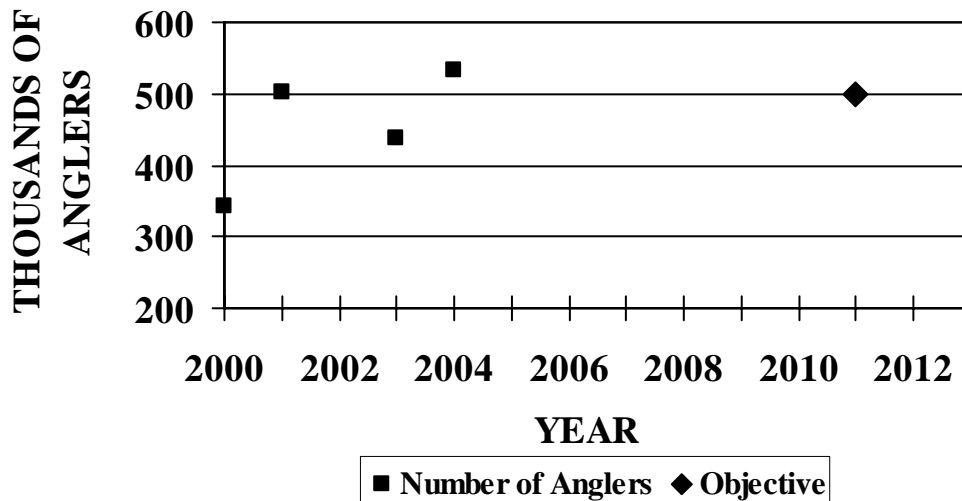


Figure 2. Number of trips to TWRA Agency Lakes during 2000 – 2004 (TWRA). The value for year 2011 is an objective for this program.



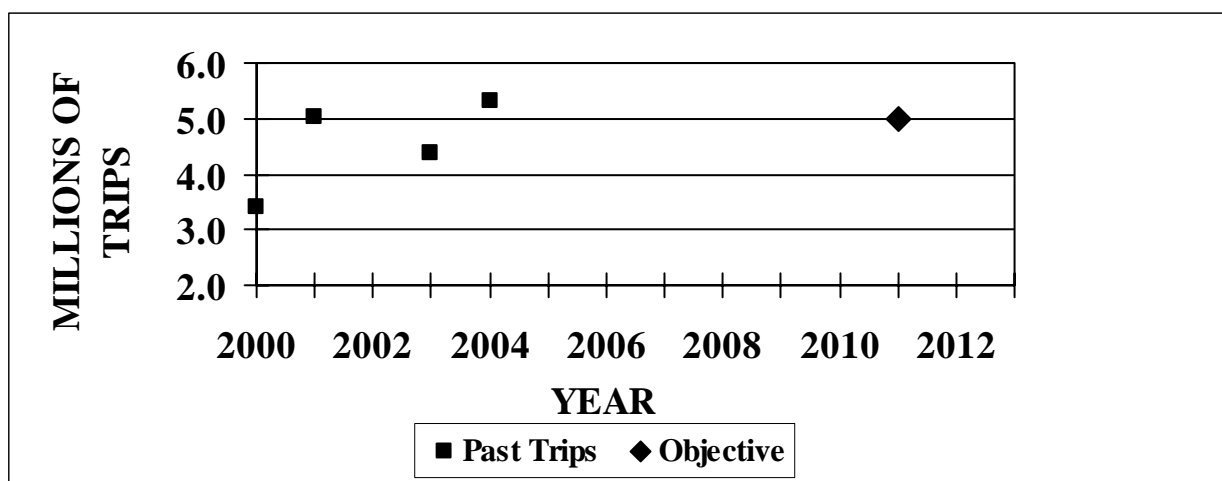


Figure 3. Number of anglers (upper) fishing Ponds and Small Lakes during 2000, 2001, 2003, and 2004 (University of Tennessee, Human Dimensions Laboratory, unpublished data).

Number of trips (lower) using an average of 10 trips per angler. The values for year 2011 are objectives for this program. Due to sampling design differences, data for 2002 was excluded.

Table 1. Statewide Number of Ponds and Small Lakes, Acreage and Trips through 2012.

YEAR	NUMBER*	ACRES*	TRIPS**
2004	198,500	99,250	4,545,000
2005	199,493	99,746	4,599,495
2006	200,490	100,245	4,654,688
2007	201,492	100,746	4,710,545
2008	202,500	101,250	4,767,071
2009	203,512	101,756	4,824,276
2010	204,530	102,265	4,882,167
2011	205,553	102,776	4,940,753
2012	206,580	103,290	5,000,043

*Estimates and expansions (0.5%) reached through agreement with the University of Tennessee Agricultural Extension Service.

**Based on the University of Tennessee 2000-2004 survey data using a 4-year mean of 454,500 anglers. An average of 10 trips per angler per year was used, then projected

by a 9% increase.

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CURRENT AND PROJECTED STATUS

The range of white-tailed deer (*Odocoileus virginianus*) in Tennessee has expanded from a few counties in east Tennessee in the 1940's to all 95 counties in the state. Herd growth has been such that hunting is allowed in all Tennessee counties with the Tennessee deer herd numbering approximately 900,000 animals. Growth of the Tennessee deer herd is expected to continue to increase at 1-2 % per year for the near future with most expansion occurring in the Mississippi River counties and in eastern Tennessee. Due to less productive habitat and other factors, eastern Tennessee has been the slowest area of the state for deer population growth. The deer herd in middle and west Tennessee has reached the point in some areas that management efforts are focused at slowing or stabilizing herd growth, and sometimes reducing the overall size of the herd. These population trends and goals should continue into the near future.

PAST, PRESENT, AND FUTURE USE

The white-tailed deer is Tennessee's most popular big game animal. The Agency's white-tailed deer program began in the 1940's with the initiation of deer restoration activities. From 1940 to 1985 over 9,000 deer were released into various counties and wildlife management areas of Tennessee. Coverage of the state was relatively complete during this effort, and deer populations were successfully established statewide (Tennessee Wildl. Res. Ag. 1991).

Because of restoration initiatives, effective game laws, and wise management, the deer herd in Tennessee has increased dramatically from approximately 2,000 deer in the 1940's to an estimated 900,000 animals in 2005. To date, the majority of the herd exists in middle and western Tennessee, while densities in the Mississippi River counties, the Cumberland Plateau, and far eastern portions of the state remain below desired levels. The increasing deer population has been reflected in an increasing harvest, which was a record 179,542 deer during the 2004/05 season (Figure 9-1). Hunter success has grown with the increasing harvests, hitting an all-time high in 2004 with 46% of deer hunters harvesting at least one deer. Although hunter numbers have declined slightly since their peak of 242,000 in 1999, they have remained relatively stable since the turn of the century, averaging 217,400 deer hunters per year (Figure 9-2).

The economy of Tennessee has benefited from the rise in deer numbers in terms of increased revenues to small businesses in rural areas, sporting goods businesses, hotels and restaurants, etc.

In 1991, hunting related expenditures had an overall impact of over \$405,238,000 to Tennessee's economy. This number doubled over five years and in 1996, hunters poured in over \$909,687,000 to the local economy. Unfortunately that number decreased in 2001 due to the slight decline in hunter numbers. Hunting expenditures in 2001 resulted in an economic impact of \$654,682,000 (USFWS 2001).

In recent years, the Agency's attention has turned to increasing and maintaining the doe harvest in order to control herd growth. This has been accomplished through liberalized antlerless bag limits, liberalized deer tagging regulations, increased seasons, and increased non-quota antlerless hunting opportunities. Overall, this strategy has worked relatively well, as most areas are harvesting the desired number of does (Tennessee Wildl. Res. Ag. 2005). The percentage of does in the overall harvest has increased steadily from 19% in 1984 to 32% in 1994 to 45% in 2004 (Figure 9-3).

In response to the growing popularity of quality deer management (QDM), the Agency has continually researched QDM initiatives. QDM is generally defined by three principles: 1.) improving or providing optimum deer habitat; 2.) adequate doe harvest; and 3.) maturation of the male segment of the herd. Although the State does not argue the importance and legitimacy of all three practices, QDM can not be practiced on a statewide basis since it is impossible for the Agency to provide optimum habitat statewide due to the expanse and physiographic variability of the land. Therefore, QDM is best left as a management tool utilized by individual hunters and/or landowners. Statewide regulations have allowed QDM practitioners to implement their strategies with great success, while also keeping non-QDM practitioners happy. Human dimension studies conducted by the University of Tennessee show a deer hunting satisfaction rate of approximately 80% between the years 2000-2004.

Historical data from Tennessee suggests that there has been no negative impact on the herd due to lower buck limits (11-buck limit pre-1998, 3-buck limit post-1998). A comparison of buck age structure from annual deer harvest suggests that the Tennessee deer herd compares favorably with those states with more restrictive buck regulations. It is the Agency's belief that hunting opportunities should be as liberal as possible without having a negative impact on the herd; therefore, more restrictive regulations should not be adopted unless it is the will of the majority of the hunting public. The Agency's deer management program has achieved an 82% approval rate utilizing this philosophy (University of Tennessee 2004).

As we progress into the future, the Agency faces a number of challenges in its deer management program. Perhaps number one among these challenges are the problems caused by the stabilization and/or reduction in the numbers of hunters. With the overall deer herd increasing at an estimated rate of 1-2% per year, and especially with the anticipated herd growth in eastern and far western Tennessee in the next few years, it will become more difficult to harvest the necessary number of does with little or no growth in hunter numbers. The second most challenging aspect results from the lack of communication between the Agency and hunters. All too often, hunters rely on outside sources of information regarding deer and deer hunting. These outside sources sometimes do not give the proper information, or even worse, feed hunters misguided, commercially based information which does not pertain to statewide management. It is in the best interest of the Agency to ensure our hunters are given the best and most accurate information possible in regards to Tennessee deer management.

Over the next 15 years, public demand for deer hunting is expected to remain at current levels or possibly increase slightly. With ever burgeoning human populations encroaching into prime deer habitat, the tolerance level of people experiencing deer damage may result in a lowering of the cultural carrying capacity. Balancing healthy deer herds and human tolerance levels will be a focus of the deer management program for decades to come.

GOALS

Goal 1: Maintain or increase herd health.

Objective 1: Maintain or increase statewide deer harvest of 180,000 deer.

Objective 2: Ensure adequate doe harvest.

- a.) In counties where it is determined that the deer population is at or above its recommended population level, the desired doe harvest shall be greater than or equal to 50% of the entire harvest.
- b.) In counties where it is determined that the deer population is slightly below or approaching its recommended population level, the desired doe harvest shall be greater than 40% but less than 50% of the entire harvest.
- c.) In counties where it is determined that the deer population is well below its recommended population level, the desired doe harvest shall be less than or equal to 40% of the entire harvest.

Objective 3: Eliminate and/or minimize disease or other factors that may affect herd health.

Goal 2: Maintain or increase hunter satisfaction while increasing hunter numbers.

Objective 1: Maintain a minimum hunter satisfaction rate of 80% and increase deer hunter success rate to 50%.

Objective 2: Increase deer hunter numbers to 220,000 and man days of deer hunting to 3.2 million.

OPPORTUNITIES, PROBLEMS, ISSUES, AND STRATEGIES

I. Problem: Many Tennessee deer hunters are uninformed or misinformed about deer management and the potential of Tennessee's deer herd which may lead to decreased hunter satisfaction...

Strategies

1. Utilize the I&E Division to conduct an educational drive to help ensure that the hunting public not only understands the basic make-up of the Tennessee deer herd but to also stress the Agency's deer management goals and the implications of any suggested or recommended regulation change. Efforts should also be made to stress the importance of the role of hunters in deer management as well as promoting the efforts of the Law Enforcement Division to boost hunter morale and compliance.

2. Utilize various media sources to educate hunters about white-tailed deer management while promoting the social value of hunting.
 - a. Internet publications and utilization of list-serves.
 - b. Public meetings (i.e. seminars, scoring rallies, etc.)
 - c. Development of informational video
 - d. Television and radio promotions
 - e. Development of printed materials
3. Develop a periodic publication that focuses on the consumptive aspects of wildlife management.
4. Improve the overall image of the Agency by ensuring and promoting high quality productions at all public events.

II. Problem: Harvest of does may not be sufficient to reach management objectives.

Strategies

1. Expand and procure funding for hunting related non-profit organizations to implement meat donation programs for hunters willing to increase their annual doe take.
2. Promote the importance of the doe harvest in the management of deer herds through various I&E outlets, especially by issuing news releases prior to the antlerless hunts, promoting hunting opportunities on public lands, and by emphasizing the importance of doe harvest through hunter education courses.
3. Investigate and develop new incentive programs to increase doe harvest when necessary.
4. Create or adjust regulations to encourage doe harvest that do not create an inherent risk to the resource.

III. Problem: Lack of public hunting in some areas reduces the Agency's ability to effectively manage the deer herd by limiting harvest capabilities.

Strategies

1. Investigate new programs to generate funds for land acquisition either through direct purchase or long-term lease options.
2. Work with public and private entities to gain access to lands by securing properties through direct purchase, long term lease, or easement options.
3. Re-evaluate the Public Hunting Area program and develop new ways to encourage the enrollment of new lands.
4. Use I&E Division to promote the benefit of hunting and encourage non-hunting landowners to provide controlled access to their lands.

IV. Problem: National trends indicate a stagnant, if not declining, segment of the population that hunts deer.

Strategies:

1. Conduct research on Tennessee demographics in an attempt to identify the

- cause of hunter decline.
2. Expand juvenile hunting programs as well as seek funding to allow increased Agency staffing and promotion of juvenile events.
 3. Develop and evaluate programs which introduce first-time hunters to the sport (i.e. Free Hunting Day, BOW).
 4. Continue to improve the Hunter Education program to entice new hunters and promote its benefits to the non-hunting public.
 5. Develop mentor programs to match individuals with limited or non-existent hunting opportunities with organizations or people willing to introduce them to hunting.
 6. Adopt regulations that encourage hunting opportunities and hunter participation (i.e. additional antlerless hunts, primitive weapon hunts, urban special seasons, etc.)
 7. Utilize I&E Division to encourage and promote hunting opportunities.
 8. Provide hunting opportunities for handicapped individuals.

V. Problem: There are differing views by hunters on what a quality hunting experience is and what type of management practices are required to give the public the best opportunity to achieve those experiences.

Strategies:

1. Establish seasons acceptable and equitable to the greatest number of hunters while protecting the resource.
2. Determine hunter attitudes through scientific sampling which utilizes random sampling techniques.
3. Provide an array of deer hunting opportunities on Wildlife Management Areas through varying deer management strategies.
4. Provide information to the public on how to manage deer according to their management goals.
5. Simplify regulations wherever possible while still managing the resource according to Agency objectives.

VI. Problem: Excessive deer numbers in both rural and urban areas sometimes result in financial burdens incurred by the general public (i.e. crop depredation, property damage, deer/car collisions).

Strategies:

1. Work with local government agencies to encourage acceptable hunting programs to alleviate urban deer problems and develop alternative control programs to deal with these problems where hunting is not feasible.
2. Maintain a statewide deer damage database and continue investigating deer depredation complaints, providing technical assistance and issuing control permits.
3. Use I&E efforts, especially using the radio and television media, to explain methods of controlling and living with problem deer.
4. Develop a program to match hunters with landowners experiencing deer

depredation problems.

5. Incorporate damage issues into the process of setting annual regulations.

VII. Problem: The collection of adequate biological data may not be adequate to evaluate herd health.

Strategies

1. Maintain the current systematic collecting of deer data at mandatory check-in stations on strategically planned days while investigating and utilizing new avenues and procedures to obtain biological data.
2. Biological report cards for Agency personnel
3. Surveys involving phone, mail, or other electronic means (Internet, R.E.A.L. system etc.)
4. Utilize the most up-to-date population and habitat models to predict herd size.
5. Investigate new data analysis procedures which make interpretation of data more accurate and less time consuming.
6. Utilize I&E to stress the importance of sound management decisions based on accurate biological data.

VIII. Problem: Many natural and unnatural factors have a negative impact on the overall health of the deer herd.

Strategies

1. Promote habitat management practices that improve the quality of the local deer habitat.
2. Work closely with other state and federal agencies in the monitoring of captive cervid facilities to prevent the spread of disease or other risks that may affect local deer populations.
3. Investigate deer health issues as they pertain to baiting, supplemental feeding, and/or mineral licks and adopt regulations to promote healthier herds.
4. Monitor diseases detrimental to deer and utilize the Southeastern Cooperative Wildlife Disease Study (SCWDS) for diagnosis and treatment of those diseases.
5. Develop informational guides to inform the public about all deer related disease issues.

IX. Problem: Illegal hunting activities impact the reported legal harvest which impedes proper management of the deer herd and decreases hunter satisfaction.

Strategies

1. Adjust law enforcement efforts to become more efficient in maintaining hunter compliance while still being responsive to the needs of the public.
2. Use I&E Division to promote hunter education programs, safety tips, and overall wildlife officer presence (i.e. Poaching Incident Report).
3. Conduct covert operations to deter significant illegal hunting activities and publicize successful efforts when completed.

- X. **Issue:** Chronic Wasting Disease (CWD) poses a serious threat to white-tailed deer management and could lead to Agency budgetary strains should the disease ever be discovered in Tennessee.

Strategies:

1. Continue CWD monitoring focusing on targeted surveillance of suspicious natural mortalities and captive cervids.
2. Adopt regulations to prevent the introduction or spread of CWD in Tennessee.
3. Develop and maintain a CWD Action Plan in the event that CWD is discovered in Tennessee, utilizing the most up-to-date management strategy as implemented by other CWD positive states.
4. Utilize an I&E effort to inform the public about the latest information regarding CWD and its limited threat to public health issues.

- XI. **Problem:** Hunter perceptions of some Wildlife Management Areas (WMAs) is that they are either inaccessible, overcrowded, do not support ample deer populations, and/or do not meet the criteria for providing a quality hunting experience.

Strategies:

1. Increase Agency personnel and maintenance budgets on existing WMAs where needed.
2. Seek ways to increase the number of WMAs statewide, increase the size of existing WMAs, and focus on strategically located WMAs to satisfy hunter needs.
3. Investigate and implement various deer management programs throughout selected WMAs to satisfy the wide range of hunter preferences (i.e. QDM, TDM, liberalized seasons, special interest seasons).
4. When possible, promote habitat management on existing WMAs that directly benefits the deer herd.

METHODS

In determining Current and Projected Status and Past, Present And Future Use, this report relied heavily on deer harvest data that was obtained through Tennessee's mandatory deer harvest check-in system. This check-in system has been in place for the majority of the time that Tennesseans have been participating in modern deer hunting. The check-in information also provided harvest figures to run and validate deer population models that are used to determine deer harvest management strategies for Tennessee counties and the state as a whole.

The Tennessee Wildlife Resources Agency thanks the following employees for their input and support as committee members on this project: Randy Cromer, Chad Gann, Dan Gibbs, Dale Grandstaff, Don King, Leith Konyndyk, Tabitha Lavacot, Ben Layton, Alan Peterson, and Daryl Ratajczak. Special thanks are due numerous Wildlife Division associates that helped with various aspects of the plan, including such assignments as

gathering data; coordinating and scheduling meetings; and proofing and editing of this document.

APPENDIX

DATA SOURCES

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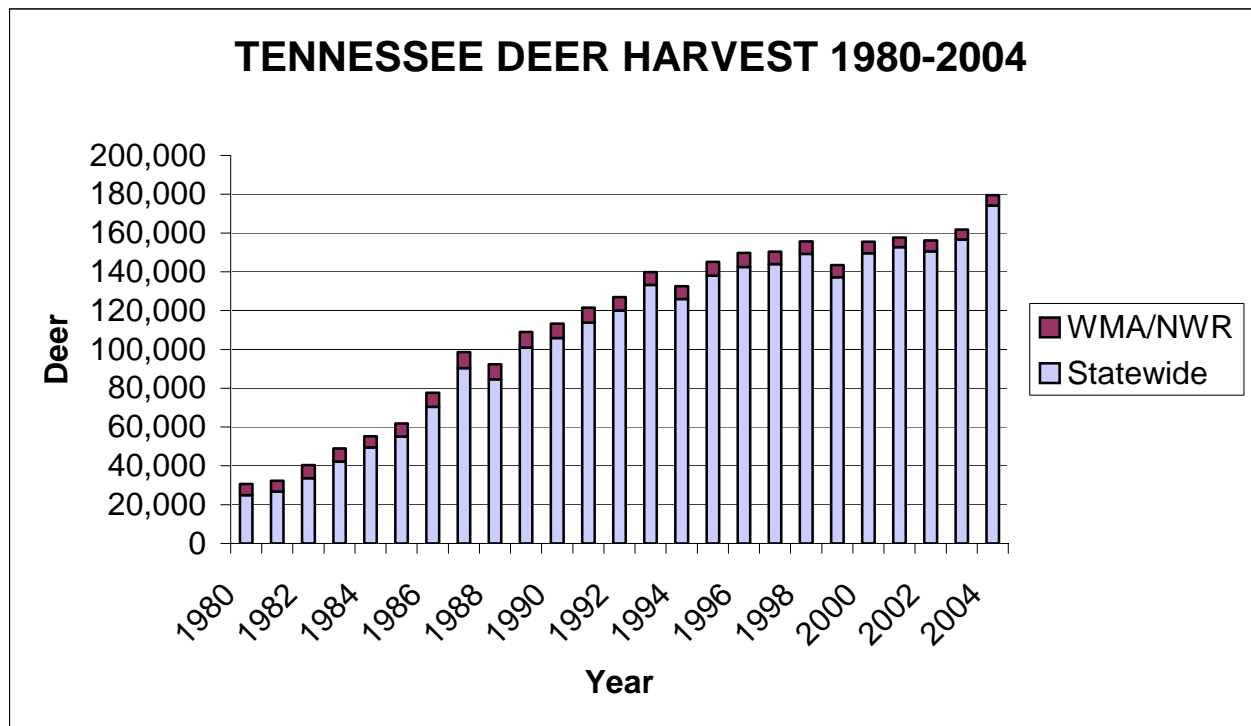


Figure 1.

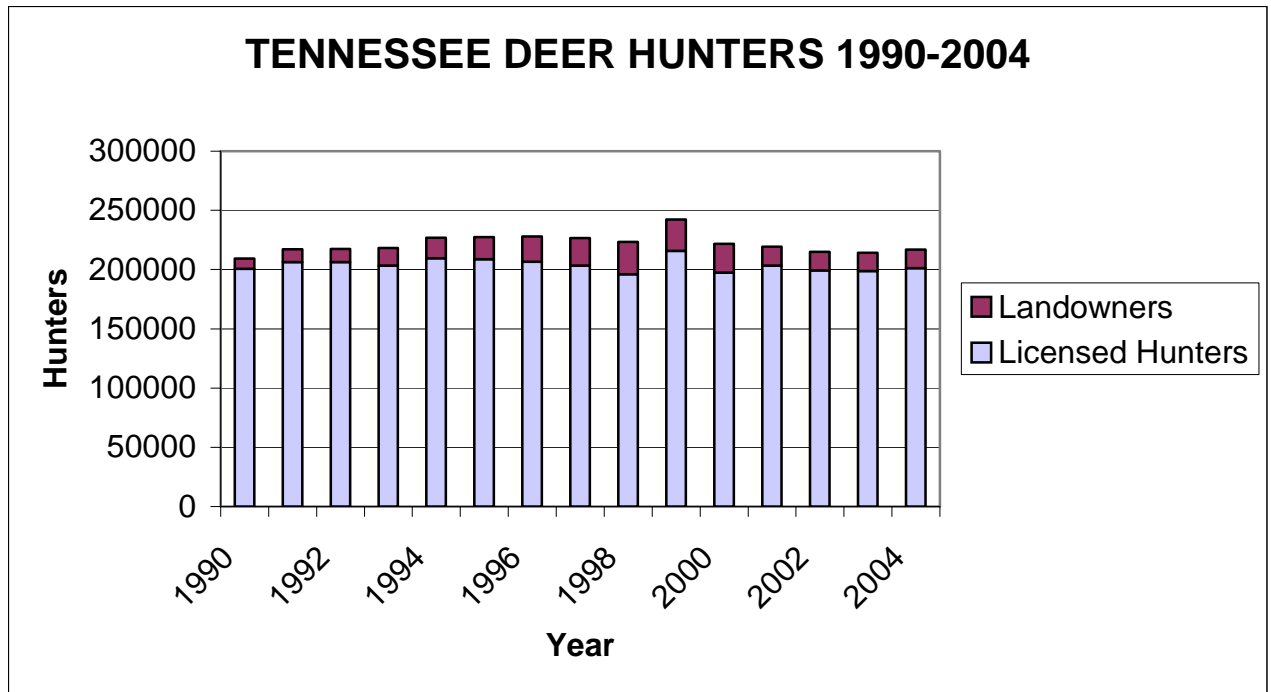


Figure 2.

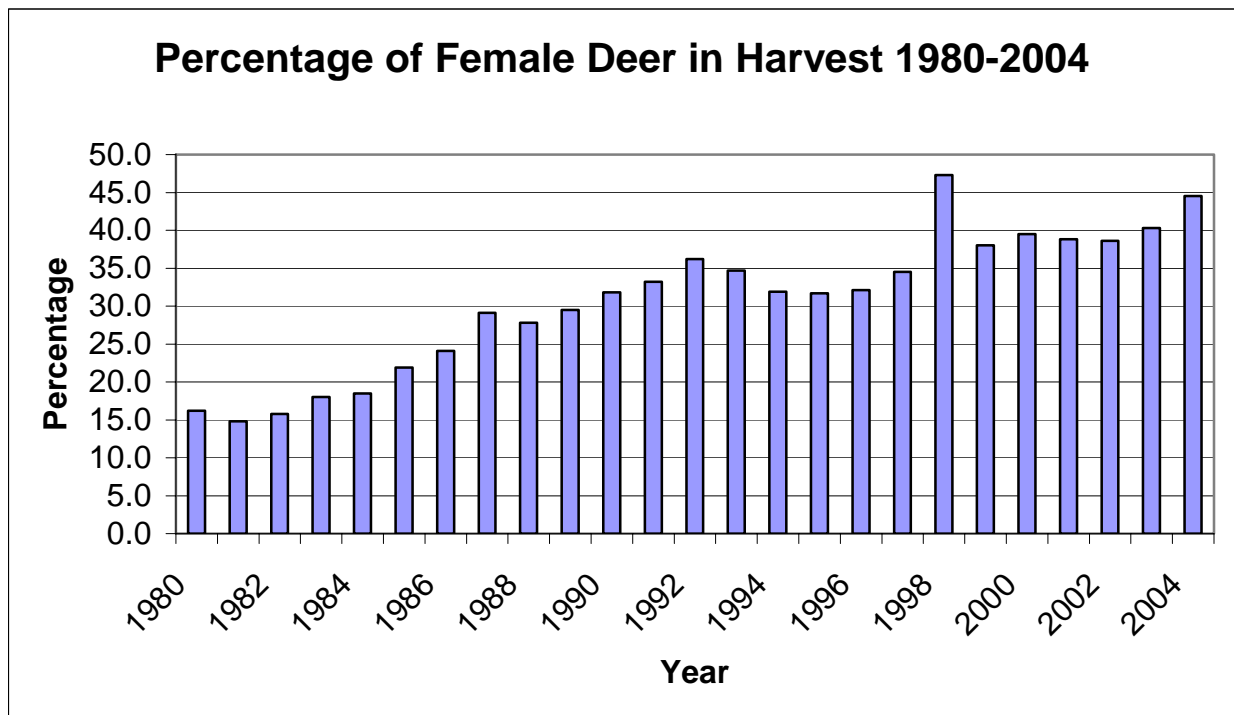


Figure 3.

CURRENT AND PROJECTED STATUS

The mourning dove (*Zenaida macroura*) is the most abundant and widespread North American gamebird (Grue et al. 1983), and is the only native species of dove in Tennessee. The introduced rock dove (or pigeon) is common in Tennessee, but is not classified as a gamebird. In recent years, there have been occurrences of the collared dove (*Streptopelia decaocto*), a native of India which has spread its range rapidly across Europe and is now found south of a line extending from North Carolina to New Mexico. Several states north of this line are also showing signs of established populations. The collared dove is fairly similar in appearance to the mourning dove, and is now occasionally harvested during the mourning dove hunting season in several middle and west Tennessee counties (pers. comm., TWRA personnel).

Mourning doves are migratory in the northern part of their range, but tend to be more sedentary in the southern portion of their range. Doves that breed farther north winter farthest south, apparently leapfrogging the wintering range of more southern breeders (Dunks et al. 1982, as referenced in Baskett et al. 1993). Orr (1973) estimated that 90% of doves harvested in September in Tennessee were born and raised in the state. Mourning doves are present statewide, but larger concentrations typically occur in the more open agricultural areas of middle and west Tennessee, and are least abundant in the more heavily forested Cumberland Plateau and Appalachian Mountain areas of east Tennessee.

Doves are a ubiquitous species and historic harvest management simply entailed monitoring trend surveys and setting regulations with little correlative or predictive ability between the two measures (Mourning Dove National Strategic Plan – Draft, 18 March 2003). Inconsistencies between several long-term trend surveys has led to uncertainty in the regional dove population trends with some showing a stable population and others showing a decline. With no ability to show a relationship between harvest regulations and the population trends, the Western Management Unit had restricted hunting opportunities in the late 1980s because of the potential decline in the dove population. Similar restrictions have been proposed by the USFWS for the Central Management Unit and the Eastern Management Unit if the dove population survey trend continued downward.

The need to ensure that management is based on a clear decision-making process has initiated national dove management strategies that are dedicated to developing guidelines for harvest management decisions and investigating the effect of harvest on dove populations. The TWRA should support this national effort through banding efforts, management, and research so that future harvest framework and regulation decisions are made from a reasonable understanding of the dove population in Tennessee and across the region.

PAST, PRESENT, AND FUTURE USE**PAST USE**

Estimates since 1951 indicate Tennessee dove hunter numbers have fluctuated between 100,000 to 175,000 hunters, apparently peaking in the 1980's. In the last twenty years as our state's population became more urban-centered and as farmland has drastically declined, finding a place to hunt has become more of a problem for dove hunters.

Even though the dove season is 60 days long, the majority of dove hunting in Tennessee occurs during the first two weeks. Though TWRA provides dove fields on many of its WMAs, there simply is not enough public dove hunting opportunities to support the demand, particularly in urban areas. Since 1988, the TWRA has had a "Public Dove Field Program" to lease fields from private landowners and allow public access for dove hunting. TWRA has leased between 13 to 40 fields each year, providing opportunity for many hunters who otherwise might not have easy access to a dove field. These leased fields are usually open for at least 3 days of hunting, and more often than not, have provided good hunting success. No additional fee or permit has been required for hunters to use these leased fields.

PRESENT USE

Estimates from the 1996-2003 UT phone surveys showed an average of 104,550 (SE 8,727) hunters annually with fluctuations from 78,432 to 142,758 during this period (Figure 10-1). An average of 524,785 (SE 59,280) hunter trips were made annually with a maximum of 609,991 trips made in 2001 and a minimum of 376,474 trips made in 2003 (Figure 10-2). Dove harvest averaged 2,381,019 (SE 291,873) birds per year with 1997 being the highest harvest (3,394,785 doves) and 2003 being the lowest harvest (1,155,775) during the period (Figure 10-3). The trend lines for number of hunters, hunter trips, and annual harvest all showed a negative slope but it is unlikely that these trends are very strong ($R^2 = 0.2134$, $R^2 = 0.2824$, and $R^2 = 0.1321$, respectively).

One debate on the dove season has centered on the timing of the opening day, whether to open on September 1 regardless of the day of the week, or to open on the first Saturday in September. Two surveys, a field interview of dove hunters by TWRA personnel (Gudlin, 1989) and a phone survey query of dove hunters (Fly et al., 1997) both indicated a fair split of opinions, with generally 50-54% in favor of September 1, and 40-46% in favor of the first Saturday in September.

In the 1994 UT telephone survey, persons indicating they hunted doves were queried on their use of public and private lands. Ninety-seven percent of the dove hunters hunted on private lands, while 22% hunted at least once on public lands. Of those hunters using public lands, 56% used TWRA leased fields, 22% used TWRA WMAs and 22% used other public lands (Fly et al. 1997).

FUTURE USE

State and national surveys indicate that the percentage of the general population that participates in hunting activity is declining, due to myriad changing social and demographic factors. Decreasing abundance of agricultural land and access to lands for hunting will provide increasing pressure on TWRA to provide dove hunting opportunities on public lands and/or to lease private lands for access. Without intensive efforts to provide hunter access and promote dove hunting, dove hunter numbers and trips will likely decline over the next 15 years. Concise definitions of baiting, limiting liability regarding unsuspecting dove hunters in baited situations, providing technical assistance to landowners in effective and legal dove field preparation, and providing abundant public dove hunting opportunities will all be needed to effectively promote dove hunting in the state.

GOAL

The goal of the TWRA Dove Program in the 2006-2012 Strategic Plan is to provide opportunities for quality dove hunting and non-consumptive experiences statewide.

OBJECTIVES

1. Increase the number of dove hunters with a minimum goal of 150,000 hunters providing 600,000 hunter trips annually.
2. Improve hunter satisfaction to a 70% annual level for TWRA's dove program for each year of the plan.
3. Actively cooperate in national and regional harvest monitoring, population monitoring, and research efforts to provide critical data for those efforts.

OPPORTUNITIES, PROBLEMS, ISSUES, AND STRATEGIES

I. Problem: Inaccessibility to huntable dove areas limits hunter opportunities.

Strategies:

1. Increase the number of leased dove fields to 40 dove fields per year statewide by exploring new ways of making the leasing of dove fields more attractive.
2. Continue providing quality dove fields for the public on our wildlife management areas.
3. Investigate improving the cost:benefit ratio to encourage landowners to contract fields specifically grown for public dove hunting.
4. Resolve landowner concerns to encourage access to huntable areas.

II. Problem: Current survey techniques have limited usefulness in determining harvest management decisions.

Strategies:

1. Cooperate with the USFWS and Eastern Management Unit (EMU) states to implement the National Dove Management Plan.
2. Participate in regional dove research to determine dove population recruitment success; factors that may be limiting or suppressing dove populations; and changes needed in regional and state dove population and hunter harvest survey methods to more accurately monitor dove population changes.

III. Problem: State and federal funds available for use in dove management are limited or declining; thus long-term objectives may not be reached.

Strategies:

1. Receive a portion of the State sales tax collected from wildlife, fisheries, and wildlife-watching supplies purchases.
2. Pursue sources of funding for dove as a non-consumptive species that will enhance habitats, populations, and viewing opportunities for dove and other non-game species.
3. Pursue other alternate sources of funding.

IV. Problem: Hunter and landowner confusion over federal dove baiting regulations.

Strategies

1. Clarify federal dove baiting regulations from the USFWS and disseminate the information to the public.
2. Provide technical assistance to the public on the preparation of a legal dove field.
3. Maintain current levels of law enforcement effort concerning hours of enforcement effort and compliance rate.

V. Issue: Effects of the expanding collared dove population on mourning dove and other native wildlife species are not known.

Strategy

1. Participate in monitoring efforts to determine status and understand local interactions between collared dove and other native species, especially mourning dove.

DATA SOURCES

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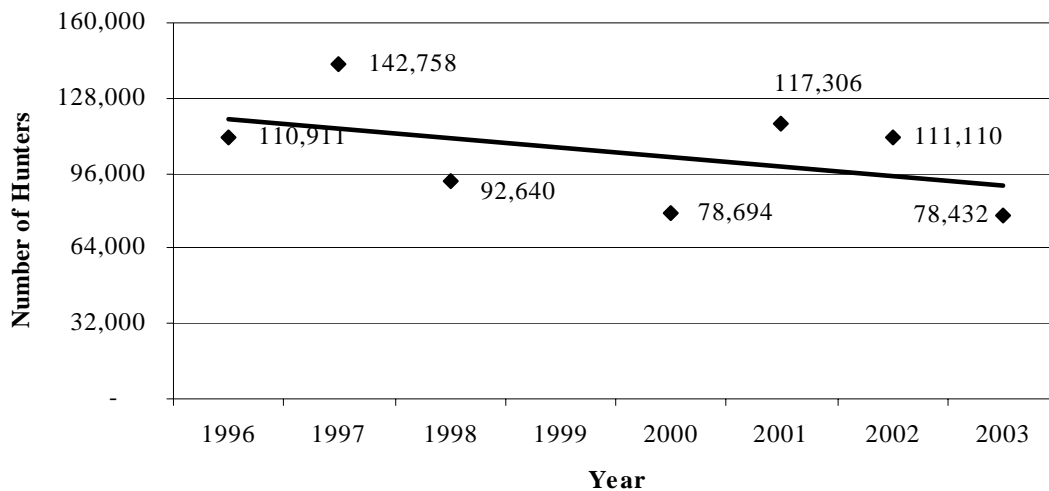


Figure 10-1. Annual estimates of the number of dove hunters in Tennessee from 1996 to 2003. Data was not collected in 1999.

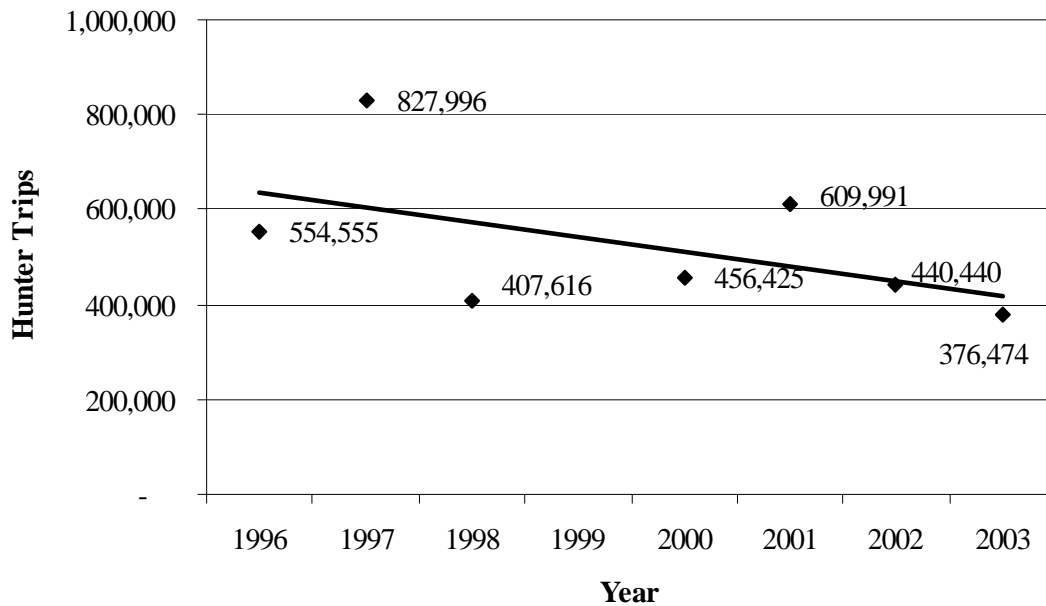


Figure 10-2. Annual estimates of the number of dove hunter trips in Tennessee from 1996 to 2003. Data was not collected in 1999.

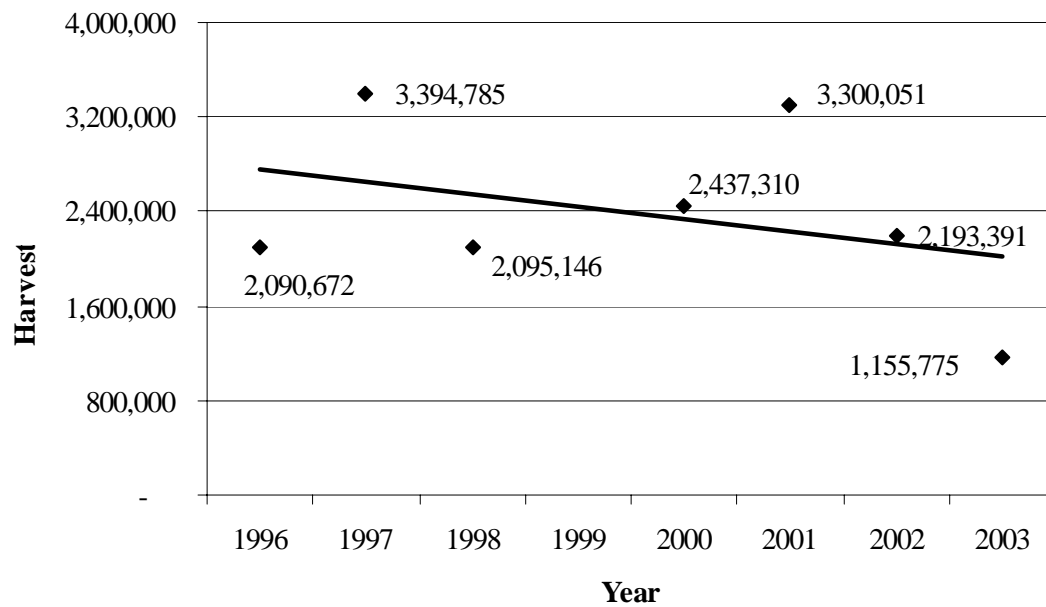


Figure 10-3. Annual estimates of dove harvest in Tennessee from 1996 to 2003. Data was not collected in 1999.

CURRENT AND PROJECTED STATUS

Tennessee's elk restoration zone is a 670,000-acre area that is located in portions of Scott, Morgan, Campbell, Anderson and Claiborne counties in eastern Tennessee. Elk restoration efforts have resulted in the release of 167 elk in the upper Cumberland Mountains. There is a large contiguous area of public land that includes the Royal Blue and Sundquist Wildlife Management Areas (WMA). These wildlife management areas have been release sites for the relocated elk. Frozen Head State Park and Ataya Public Hunting Areas also provide public access within the elk zone.

Currently, more data is needed in order to make an accurate estimate of the elk population. Plans are being made to conduct an aerial census this Fall/Winter of 2005. The elk are reproducing and efforts are being conducted to document calf sightings.

Originally, 160 elk were equipped with radio telemetry devices. All elk were ear tagged for identification. The University of Tennessee, Department of Forestry, Wildlife and Fisheries has 2 graduate students conducting research. The student's field studies are completed and data are being evaluated. Tennessee Wildlife Resources Agency (TWRA) and volunteer personnel are currently monitoring the radio-tagged animals. The University of Tennessee College of Veterinary Medicine monitors the health of the elk. They provide assistance with elk relocations, which give the veterinarians an opportunity to examine live animals. Necropsies are conducted on dead elk to determine the cause of death and to monitor for parasites and diseases.

The elk restoration plan calls for an elk herd to number between 1,400-2,000 animals in 20 years.

PAST, PRESENT AND FUTURE USE**PAST USE**

The eastern subspecies of the North American elk (*Cervus elaphus canadensis*) was apparently abundant in Tennessee prior to settlement by Europeans. Early records describe elk living with buffalo, deer, bear and other wildlife. As settlement of the eastern United States accelerated, the elk were eliminated from the landscape. The eastern subspecies was completely extirpated from its historical range. Records indicate that the last elk in east Tennessee was shot in 1849.

Interest in reintroducing elk in the eastern United States has been growing. The states of Arkansas, Kentucky, Michigan, Pennsylvania and Wisconsin have had successful results at establishing elk herds.

In 1996, TWRA evaluated the potential for establishing an elk herd in Tennessee. In 1997, TWRA proposed an elk reintroduction program for Land Between the Lakes in western Tennessee. Due to strong local opposition the Agency did not move forward with the project. In 1999, local citizens from the northern Cumberland Plateau region of eastern Tennessee expressed interest for the project. Public meetings were held and a formal request to support elk restoration was submitted to the Wildlife Resources Commission in August 2000. On December 19, 2000, the first 50 elk were obtained from Elk Island National Park (EINP), Alberta, Canada. They were released on the Royal Blue WMA. There have been releases of EINP elk in 2001 and 2002. The last release of thirty elk took place in 2003 with these elk coming from Land Between the Lakes, Kentucky.

PRESENT USE

There is currently no hunting season established for elk in Tennessee. There is significant public interest for elk viewing and many people visit the Royal Blue and Sundquist WMA with anticipation of viewing elk.

TWRA continues to monitor the herd and evaluate options for obtaining more elk for reintroduction. Habitat improvements on Royal Blue and Sundquist WMA provide habitat for elk and other wildlife. Public programs, television shows, news releases and other printed media are used to provide the public with information about elk ecology and the restoration project.

FUTURE USE

The future goal of the elk restoration project is to complete the needed relocations of additional elk. TWRA will be seeking additional elk in the near future. Habitat improvements will be made to State-owned lands. Recommendations will be made to interested landowners that want to provide elk habitat. An elk hunting season will be established.

Public use of this resource will be enhanced over the next 15 years. TWRA along with the elk restoration partners will provide elk hunting, promote elk viewing and assist landowners in improving elk habitat on private lands.

GOALS AND OBJECTIVES

GOAL:

Restore elk to a portion of its former range and develop a self-sustaining huntable elk herd.

Objective I:

Develop and begin implementation of a habitat management plan by December 2007.

Objective II:

Relocate a minimum of 600 additional elk within four years.

Objective III:

Conduct Tennessee's first elk hunting season.

Objective IV:

Decrease mortalities.

Objective V:

Establish a comprehensive elk Information and Education plan.

Objective VI:

Reduce the potential to spread disease through movement and trade of captive cervids.

I. Problem: There is not sufficient information to adequately assess herd status.

Strategies:

1. Investigate new census methods.
2. Monitor elk mortalities to determine the impact on population growth.
3. Continue elk calf data collection.
4. Investigate potential cervid population models.

II. Problem: Elk must be a priority species in the Royal Blue and Sundquist Wildlife Management Area plan.

Strategy:

1. Develop a habitat management plan for the Royal Blue and Sundquist Wildlife Management Areas.

III. Problem: The potential loss of habitat from commercial and real estate development.

Strategy:

1. Secure habitat cores and corridors throughout the elk restoration zone.
2. Cooperatively work with public and private landowners to maximize habitat improvements for elk.

IV. Problem: Committing funds to obtain additional elk.

Strategies:

1. Obtain cost estimates on funds needed to acquire elk from Canada, Kentucky and the Western United States.
2. Elk restoration partners will develop and implement fund raising plans.

V. Problem: The lack of genetic diversity may limit herd growth and viability.

Strategy:

1. Enhance the genetic variability of the herd by obtaining elk from genetically diverse populations.

VI. Problem: Obtain elk from areas that are approved by the State Veterinarian.

Strategy:

1. The State Veterinarian will develop health recommendations on elk importations.

VII. Problem: Develop criteria for an elk-hunting season.

Strategies:

1. Elk hunting will take place when the elk population reaches four hundred animals and the herd is self-sustaining.
2. Design a quota hunt permit allocation system that will attain the desired elk harvest and hunter success rates.

VIII. Problem: The mortality rate is too high to grow the herd to the desired levels.

Strategies:

1. Increase habitat improvement efforts.
2. Evaluate the options for reducing the impact of meningeal worms.
3. Increase law enforcement presence in the restoration zone by TWRA personnel and implement innovative law enforcement techniques.

IX. Problem: Lack of suitable viewing sites.

Strategy:

1. Identify and develop sites where there is a high probability of viewing elk.

X. Problem: Public information on viewing sites is lacking.

Strategy:

1. Develop public information on elk viewing opportunities that include maps, magazine articles, viewing tips and media coverage

XI. Problem: Public information in various forms about Tennessee elk is lacking.

Strategy:

1. Develop informational materials for public use utilizing print and electronic media including stand-alone and web-based material.

XII. Problem: Strengthen regulations for the importation of captive cervids into Tennessee.

Strategy:

1. Work with the Tennessee Department of Agriculture (TDA) in the development and implementation of (TDA) regulations.

Sources:

Toweill, D.E. and J.W. Thomas, editors. 2002. North American Elk Ecology and Management, Smithsonian International Press. Washington, D.C., USA.

The Tennessee Wildlife Resources Agency (TWRA) would like to thank the members of the taskforce and the organizations they represent in working to develop TWRA's first elk strategic plan, 2006-2012.

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CURRENT AND PROJECTED STATUS

Tennessee has one species of quail and three species of rabbit. The northern bobwhite quail (*Colinus virginianus*) is the only species of quail native to the eastern United States, and is Tennessee's state game bird. Three species of rabbit are found in Tennessee. The eastern cottontail (*Sylvilagus floridanus*) is found statewide, and is easily the most abundant of the Tennessee rabbits. Due to the statewide distribution and relative abundance of the bobwhite quail and the eastern cottontail, and their close association with farmland habitats, quail and rabbits are collectively referred to by TWRA as "farm game". They generally are most abundant in the areas of middle and west Tennessee dominated by grain row crop agriculture. However, they are known to occur in habitats as extreme as high mountain grassy balds over 5,000 ft. in elevation in east Tennessee.

The swamp rabbit (*S. aquaticus*) is found in bottomland hardwood areas of west Tennessee. Swamp rabbits are the largest of the three species, with females weighing up to 6 lbs. Although not well documented quantitatively, it is recognized that the range and abundance of the swamp rabbit has drastically been reduced in the 1900's due to the drainage of wetlands and alterations to the natural riparian ecology in west Tennessee. In the 1980's alone, it is estimated that 189,000 acres of bottomland hardwoods were destroyed (May 1991).

The Appalachian cottontail (*S. obscurus*, formerly known as the New England cottontail, *S. transitionalis*) is the smallest of the three rabbits. Their range is thought to be fairly limited to the higher (above 2,500 ft.) elevations of the Appalachian Mountains in east Tennessee. Along with their association with alpine habitats, Appalachian cottontails are recognized by their small size, slightly darker color, a black line along the anterior edge of the ears, and often a small black spot in the middle of the forehead.

PAST, PRESENT, AND FUTURE USE

Up to the 1950's, abundant farm game populations were essentially a free "by-product" of land management practices of those times. It is likely that quail and rabbit populations were as high in the early 1900's as they have ever been in the history of the U.S. Many of the land practices (small tenant farms which grew weedy grain crops and had abundant fence rows and idle native grassland and annual lespedezas; abandoned farmland reverting to native grasses and shrubs) naturally provided good farm game habitat. As we prepare to enter the 21st century, the scenario is almost the exact opposite. In the Southeast, unless you are managing land specifically with farm game as a consideration, there are few land management practices normally done in our society that are favorable for farm game.

One major problem is direct loss of habitat. While the rate of loss has slowed, between 1998 and 2002 the rate of loss of farmland is still approximately 135 acres per day/50,000 acres per year (Tennessee Agricultural Statistics Service, 2004). The rate of loss of "prime" farmland between 1992-1997 increased 42% over the previous 5-year period (American Farmland Trust 2004).

Other trends compound the problem: small farms are conglomerated into corporate farms and fence rows are removed to accommodate large farm machinery; crop fields are generally weed-free and any grassy borders are frequently mowed; double-cropping is common; pastureland is intensively grazed; native grasslands have been replaced by introduced tame grasses; and odd areas are mowed for aesthetics. In addition, predation may also be suppressing farm game populations in areas of increased predator populations and greatly restricted nesting habitat.

Since 1970, farm game populations, and subsequently hunters, hunter trips and harvest, have steadily and drastically declined. It is estimated that between 1980 and 1999, the bobwhite population and harvest in the Southeast states decreased 66% (Dimmick et al. 2002). The numbers of farm game hunters in Tennessee peaked about 1955, when there were estimated 139,307 quail hunters and 228,019 rabbit hunters in the state (Table 1). Hunter numbers have also declined drastically to estimated 29,117 quail hunters and 66,890 rabbit hunters in 2004.

Prior to 1975, Tennessee's quail and rabbit seasons typically opened on or near Thanksgiving Day (Tables 2 and 3). Biologically, quail and rabbit seasons could open as early as November 1, and provide additional hunter opportunity and increased harvests. TWRA demonstrated the feasibility of such a season on the Laurel Hill WMA in 1971 (McConnell, 1972). Subsequently, in 1975, the Tennessee Wildlife Resources Commission opened the statewide quail and rabbit seasons on November 1. However, in 1976 the opening day was set on the second Saturday in November, which has since become standardized as the opening date. This day is viewed as an acceptable compromise between biological impacts, hunter concerns (annual game population abundance, weather influence on hunter comfort and dog performance), and landowner concerns (hunters trampling through standing crops). In an average year, over 90% of the corn and milo and 75% of the soybeans are harvested by November 15.

During the next 15 years the demand for quail and rabbit hunting will remain approximately the same as now.

Past Programs and Management Efforts

Propagation and Stocking

During the early days of the Tennessee Game & Fish Commission (predecessor to the TWRA), habitat was still quite abundant statewide, and hunting access to private lands was seldom a problem. Even in those old "glory days", hunters still desired more abundant game populations, and the popular approach was to stock pen-reared game. The main emphasis by the TGFC was the production and stocking of pen-reared quail on properties that did not support wild birds in sufficient numbers. This operation was centered on the agency's Buffalo Springs facility. From 1936 to 1957, the primary objective of the Buffalo Springs Game Farm was to produce and distribute bobwhite quail in wholesale lots. Those quail were distributed as adults through Conservation Officers in every county to landowners, who released them on their property. Quail were also distributed as 7 to 10 day old chicks to youth groups and sportsmen's clubs. These groups raised the birds to approximately 8 weeks of age, and released them on selected sites.

Although this program was tremendously popular, data collected over the years indicated that the propagation and release of pen-reared quail was not effective in restoring wild quail populations. As a result, the last release of quail from the game farm occurred in 1958.

Largely in response to the phenomenal success of the introduction of the ringneck pheasant in the U.S., the late 1950's and 1960's brought an era of attempted introductions of exotic wildlife in hopes of increasing the number and varieties of game species to be hunted. These efforts were spearheaded by the U.S. Fish & Wildlife Service and were undertaken by a multitude of state game agencies.

Thus in 1957, the mission of the Buffalo Springs facility was changed from the mass production of bobwhites to a program of research and study of exotic birds. The focus was to identify species which demonstrated characteristics that might enable them to supplement wild bobwhites in areas where changing habitat and farming practices had made the region no longer ideal for large populations of quail.

One of the most promising of these experiments involved the introduction of the coturnix quail (*Coturnix coturnix*). Beginning in April 1956 with the receipt of 49 pairs to be used as brood stock, this effort continued until October of 1959, when it was determined that proliferation of the species in Tennessee was not likely. Similar results were experienced with chukars (*Alectoris chukar*), California quail (*Lophortyx californicus*), junglefowl (*Gallus gallus*), black francolin (*Francolinus francolinus*), whitecrested kalij (*Lophura leucomelana*), bamboo partridge (*Bambusicola thoracia*), and a variety of pheasant species (*Phasianus* spp.)(TWRA files). An introduction of ringneck pheasants (*Phasianus colchicus*) was also attempted in 1969-70, but apparently did not result in establishment of a sustainable population (Easterly, 1970; pers. comm. TWRA personnel). Thus, none of the efforts to establish sustainable populations of non-native game birds were successful.

Public Lands Acquisition

The results of these and other studies continually indicated that the preservation and maintenance of proper habitat is essential to increasing populations of wild bobwhites. Although programs to improve quail habitat on private land had existed for a number of years, no serious efforts had been made to acquire lands for public hunting. By the late 1950's, only the AEDC WMA provided any appreciable degree of farm game hunting.

In 1958, land acquisition for small game hunting was given a higher priority. By 1968 two areas had been secured, one through purchase (Laurel Hill WMA, Lawrence Co.) and one through license agreement (Percy Priest WMA, Rutherford Co., U.S. Army Corps of Engineers). Although a few small areas were acquired after that, the Agency decided that land acquisition targeted at providing farm game hunting was too costly for the benefits realized. Most land subsequently acquired has been for big game or waterfowl. It wasn't until the Pubic Hunting Areas program began in the mid-1980s that public acreage providing quail and rabbit hunting was expanded. While not the result of a focused objective to obtain farm game habitat, the TWRA acquired some lands in the 1990's with excellent farm game potential, including the Wolf River WMA in Fayette County and the Haynes Bottom WMA in Montgomery County (wetlands acquisition program), the Williamsport WMA in Maury County and the Bridgestone/Firestone

WMA in White and Cumberland counties (donation), and the Yanahli WMA in Maury County (disposition of land by TVA).

In the last 10 years, a greater emphasis has been placed on public lands farm game habitat. Cooperative projects done on Public Hunting Areas and WMAs by Quail Unlimited chapters and largely funded through TWRA's "Farm Wildlife Habitat Program" have significantly increased farm game hunting and/or dog training opportunities on public lands, most notably in TWRA Region III. Room for further improvements still remain.

Private Lands Management

Agency efforts to improve farm game habitat on private lands can be traced back to 1949, when the TGFC instituted a program to produce and distribute planting materials to landowners. Bicolor lespedeza, japonica lespedeza, and multiflora rose seedlings and partridge pea seed were produced at the TFGC's plant nursery and were distributed to landowners free-of-charge. Technical assistance was given to individuals and cooperating government agencies regarding improving wildlife habitat on their properties.

In 1953, a program was established to supply interested landowners with small amounts of annual seed mixtures to be planted on their land. Efforts were made to encourage these landowners to increase farm game acreage. In 1962, it was determined that the Agency efforts were not resulting in substantially increasing private lands wildlife habitat on a statewide basis.

In 1974, a new technical guidance program was develop, which included the hiring of 4 full time biologists to handle the technical aspects of the farm game program, cooperative programs with the UT Agricultural Extension Service and the Soil Conservation Service. Evaluation of the private lands technical assistance program, however, indicated that only about 25% of the plans written by TWRA biologists were actually implemented. Due to its relative ineffectiveness, the program was de-emphasized.

In September 1987, TWRA initiated a new small game program in response to new management opportunities in the 1985 Farm Bill and the Conservation Reserve Program (CRP), the enrollment of 670,000 acres of timber company lands into TWRA's new Public Hunting Areas (PHA) program, and the growth of the Quail Unlimited organization in the state. A statewide Small Game Program Coordinator position was established, and over \$500,000 annual budget was allotted to the effort. Many management efforts were taken, most notably initiation of the "Upland Game Bird Habitat Program" (now the Farm Wildlife Habitat Program), which provided technical assistance and cost-share assistance to interested landowners, and a CRP bonus payment program to encourage CRP landowners to plant vegetation beneficial to farm game.

Because the majority of Tennessee's public lands are forested or wetlands and 90% of Tennessee are private lands, the real key to preserving and improving farm game populations lies in private lands management. However, influencing large-scale changes on private lands management is extremely difficult.

Since 1985, the emphasis on has continued to shift away from commodity support programs to conservation programs. Wildlife has also received an increasing emphasis in each Farm Bill. The Conservation Reserve Program (CRP) has been the “cornerstone” conservation program since 1985. While we are seeing notable increases in wildlife habitat in CRP in Tennessee and response by bobwhites in landscapes with CRP native grasses (Hansbrough and Gudlin 2003). While any individual state or federal conservation program will likely not be the solution to restoring bobwhites, maximizing wildlife benefits in all possible conservation programs have the potential to restore populations of bobwhites and other declining wildlife on our rural landscape. In the 2002 Farm Bill programs alone, over \$3.2 billion annually was appropriated – far more than all other funding available to state wildlife agencies nationwide.

Development of the Northern Bobwhite Conservation Initiative (NBCI) (Dimmick et al. 2002) has provided guidelines for range-wide recovery of bobwhites. The initiative has already garnered much support and action by state wildlife agencies, the International Association of Fish & Wildlife Agencies, non-governmental organizations, and other groups, including the establishment of a National NBCI Coordinator, and addition of the CP33 Habitat Buffers for Upland Birds in the CRP Continuous Signup by USDA.

Past Use

In Tennessee, rabbit hunter numbers have typically been about double the number of quail hunters. Obvious causes for hunter declines are declines in farm game populations, loss of farmland, loss of access to farmlands with huntable populations (posting of lands to hunting; leases by deer hunting groups), expansion of big game hunting opportunities, and the continual move from a rural-based to an urban-based society.

Present Use

Hunter numbers have continued to decline during the past strategic planning period. Currently quail hunters' number about 29,117, and rabbit hunters number about 66,890. Although there are fewer hunters, those left tend to be “hard-core”, and are intensely interested in their sport. Recruitment of young hunters into the sport has been lagging, as evidenced by the increasing average age of quail and rabbit hunters. Many conservation organizations are now targeting efforts to increase interest in the sport by youth, women, and third generation urbanites.

Future Use

Other state and national surveys indicate that the percentage of the general population that participates in hunting activities is declining due to myriad changes in societal and demographic factors. Unless habitat loss and species declines are significantly slowed in this next decade, the future of the sport is uncertain. Efforts which impact landscape scale changes on private lands habitat resulting in increased farm game populations, increase in access to huntable farm game populations, and recruitment of youth into farm game hunting will be essential to the success of this program.

While previous Breeding Bird Survey data indicated a steady downward decline of bobwhites, it appears that since 1999 bobwhite populations in Tennessee have begun to stabilize, meeting the first 5-year goal of the NBCI.

GOAL

To increase farm game habitat and populations, hunter numbers and hunter opportunity on private and public lands.

OBJECTIVES

1. Achieve 30% of Northern Bobwhite Conservation Initiative (NBCI) habitat goals for Tennessee for this strategic plan period. While maintaining suitable farm game habitat available in 1999 (which in itself will be difficult, as urban sprawl continues to consume farmland habitat), we need to add an additional 209,258 acres of quality nesting habitat to Tennessee, which would result in an estimated increase of 47,693 bobwhite coveys.
2. Achieve resulting population increases from NBCI implementation to result in a corresponding increase in the bobwhite Breeding Bird Survey index in Tennessee for this strategic period.
3. Increase hunter success rates for quail and rabbit 20% over the previous strategic plan period.
4. Increase 2006 hunter numbers by 5% and hunter trips by 5% over the previous strategic plan period.
5. Step down the Northern Bobwhite Conservation Initiative to state Bird Conservation Region (BCR) farm game plans, including county level goals.

I. Problem: Low farm game populations due to lack of quality habitat on public and private lands.

Strategies

1. Influence wildlife-beneficial changes in USDA conservation programs and promotion of practices beneficial to wildlife by USDA and the UT Agricultural Extension Service.
 - a. Provide comment as appropriate to USDA regarding specific programs and wildlife benefits and mechanisms desired in 2007 Farm Bill.
 - b. Be actively involved in state, regional and national efforts to influence Farm Bill legislation.
 - c. Be actively involved in NRCS State Technical Committee.
2. Increase TWRA staff to expand private lands technical assistance capabilities.
3. Promote the creation of a Mid-South Native Grasslands Restoration Center of Excellence at the University of Tennessee to achieve increased utilization of native grasses in agricultural and forestland ecosystems. Through the Center, develop and support research intended to fill informational gaps that would help promote native grasses and associated wildlife practices from the economics and agronomics benefits and perspectives.

4. Encourage increased participation of landowners in federal conservation programs.
5. Encourage pasture/hay land conversion to wildlife friendly habitat.
6. Establish and maintain wildlife-friendly borders, and implement fescue eradication and native grassland restoration on all TWRA-managed lands and encourage other public lands use agencies to do the same.
7. Increase the use of prescribed burning on private and public lands utilizing: payment incentives, regional burn teams, more burn equipment, training.
8. Encourage cooperative partnerships between TWRA and other non-government organizations.
9. Pursue and/or support initiatives to keep farmland protected or preserved as farms.
10. Encourage woodlands management practices that benefit small game.

II. Issue: State and federal funds available for use in farm game habitat management, restoration, and protection are limited and in some cases declining.

Strategies

1. Identify and utilize non-TWRA (federal conservation programs, grants, etc.) funds and programs where possible to promote and implement farm game habitat. Utilize TWRA funds and programs (Farm Wildlife Habitat Program, Farm Bill incentives, etc.) to fill in gaps and/or encourage utilization of federal programs.
2. Increase TWRA staff to expand farm game technical assistance capabilities and to better and more efficiently utilize existing funds and programs.
3. Seek legislation for landowner tax relief and incentives for landowners to establish and maintain wildlife habitat.
4. Pursue a Grasslands or Uplands fund similar to the Wetland fund for upland habitat acquisition.

III. Problem: Lack of understanding of farm game habitat needs and impacts among land managers, farmers, land use agencies, developers, and the general public; and awareness of programs and opportunities.

Strategies

1. Integrate bobwhite quail habitat needs and goals in national plans and other joint ventures.
2. Improve/maintain TWRA website with habitat information.
3. Dedicate funding to ensure adequate supplies of current and future educational materials such as: NWSG booklet, land managers guide, food-plot guide, etc.
4. Target co-ops, other farm supply outlets, NRCS, and UT Agricultural Extension Service county offices with approaches such as interactive computer information centers and displays about farm game and conservation programs.
5. Train and educate TWRA staff, officers, personnel and the general public about farm game issues and habitat management practices.
6. Have more WMAs serve as demonstrations for optimum farm game habitat practices.
7. Conduct more field demonstration days/workshops to educate landowners, land managers, and conservation agency personnel about farm game issues, habitat practices, and conservation program applications.

8. Maximize coordination of program efforts with similar resource concerns (Partners In Flight, TN Div. Of Forestry, Water Quality incentives, TNLIP, SWG, etc.).
9. Maximize the utilization of current technology such as the TWRA website, the proposed TWRA TV show, PSAs and infomercials, and press articles to educate the public on farm game and habitat issues.
10. Support and/or participate in research efforts to better understand farm game population responses from habitat-oriented programs, predation, and other issues.
11. Develop landowner-marketing program to target specific landowners and promote various programs.
12. Increase invasive exotic species control: educate landowners, land use agencies, developers, construction contractors, mine reclamation industry, and others on the problems with invasives and provide good alternatives.
13. Work with Office of Surface Mining to improve mineland reclamation practices by reducing reliance on invasive exotic vegetation and implementing renovation and revegetation strategies to maximize wildlife habitat.
14. Develop a program that will track all habitat improvement accomplishments that are performed by all state and Federal agencies in Tennessee.

IV. Problem: Insufficient farm game hunter opportunity due to lack of access to lands and competition between hunter groups.

Strategies

1. Increase hunting opportunities for the public.
 - (a) Increase PHA Program acreage.
 - (b) Develop new Hunting Lease Programs to lease private lands with good habitat for prime periods during the hunting season.
 - (c) Explore the feasibility for a federal tax incentive to provide easements for hunter access.
 - (d) Support and pursue options in federal “open fields” initiative.
2. Develop a brochure on leasing land to the public; update or use the UT brochure; print and provide to Regional Offices.
3. Encourage landowners to make more deer hunting leases available to small game hunters after deer season.
4. Work with large private, industrial, timber companies to increase small game hunter access after deer season.

V. Problem - Better harvest and population survey data is needed on which to base management decisions.

Strategies

1. Increase participation in avid hunter surveys by:
 - (a) Placing displays with survey cards in sporting goods stores and farm supply outlets.
 - (b) Including survey cards as an insert in appropriate issues of *Tennessee Wildlife*.
 - (c) Post survey cards on the TWRA webpage.

- (d) Advertise the survey in appropriate hunting magazines.
2. Continue the telephone survey to estimate hunter numbers and trips, and to monitor hunter opinion on farm game issues.
3. Initiate an on-line sample based hunter survey.
4. Investigate the possibility of mining hunter demographic data at license point-of-sale.
5. Improve human dimensions data collection and use of such info.

VI. Problem: Lack of recruitment of new hunters into farm game hunting contributes to declining numbers of farm game hunters.

Strategies

1. Increase youth recruitment.
2. Increase youth hunts on selected WMA's.
3. Cooperate with Quail Unlimited on youth camps and other ventures to create youth interest in farm game conservation and hunting.
4. Promote youth shooting sports in schools.
5. Encourage sportsmen's groups to host high school shooting teams, 4-H and FFA or other youth organizations on a rabbit or quail hunt.
6. Increase the number of women small game hunters; promote the BOW program
7. Improve/continue the TV program and other media outlets to promote small game hunting.

VII. Issue: Compliance with TWRA laws and regulations is needed to protect the resource.

Strategy

1. Provide law enforcement to maintain a compliance index of 95% while checking 600 quail hunters, and to maintain a compliance index of 95% while checking 1,000 rabbit hunters.

METHODS

The Farm Game Strategic Plan was developed by the following Task Force: Tim White, Chairman (TWRA Waterfowl Program Coordinator), Mark Gudlin (TWRA Private Lands), Ed Harsson (TWRA Region I), Russ Skoglund (TWRA Region II), Roger Applegate (TWRA Small Game Program Coordinator), Greg Wathen (TWRA Assistant to the Director), Chris Wolkonowski (NRCS), Robin Mayberry (NRCS), and Gregg Piercey (QU). Committee meetings were held in Nashville on April 8 and August 4, 2005.

As suggested by the USFWS's Management Assistance Team, the committee used "brainstorming" techniques to develop and organize the goal, objectives, problems and strategies. Objectives, problems and strategies were then scored by individual team members, and prioritized in order of highest score, which designated highest priority. The plan was then reviewed and revised where deemed appropriate by the TWRA Director's Staff in a meeting in Crossville on November 17, 1999.

Copies of the draft plan were available for public review December 15, 1999 - January 31, 2000. Review was solicited both through direct mailing of the plan to known interested parties and solicited by the general public through statewide news releases in order to determine the public's opinions on problems and strategies.

Program summaries for TWRA and USDA habitat programs in Tennessee will be used to monitor progress for Objective 1. The USGS Breeding Bird Survey will be used to monitor progress on Objective 2. Hunter success as measured by the TWRA quail and rabbit hunter survey cards will be used to monitor progress on Objective 3. The telephone survey conducted for TWRA by the University of Tennessee will be used to monitor progress on Objective 4.

APPENDIX

DATA SOURCES

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Table 1

TENNESSEE QUAIL HUNTING SEASONS, 1940-2004

YEAR	SEASON DATES	BAG LIMIT	COMMENTS	YEAR	SEASON DATES	BAG LIMIT	COMMENTS
03-04	NOV 8-FEB 28	6		69-70	NOV 17-FEB 15	8	
02-03	NOV 9-FEB 28	6		68-69	NOV 18-FEB 15	8	
01-02	NOV 10-FEB 28	8		67-68	NOV 20-FEB 15	8	
00-01	NOV 10-FEB 28	8		66-67	NOV 21-FEB 15	8	
98-99	NOV 14-FEB 28	8		65-66	NOV 22-FEB 5	8	
97-98	NOV 8-FEB 28	8		64-65	NOV 23-FEB 6	8	
96-97	NOV 9-FEB 28	10		63-64	NOV 18-JAN 25	8	
95-96	NOV 11-FEB 29	10		62-63	NOV 19-JAN 25	8	
94-95	NOV 12-FEB 28	10		61-62	NOV 20-JAN 25	8	
93-94	NOV 13-FEB 28	10		60-61	NOV 21-JAN 25	10	
92-93	NOV 14-FEB 28	10		59-60	NOV 27-JAN 25	8	
91-92	NOV 9-FEB 29	10		58-59	NOV 27-JAN 25	8	
90-91	NOV 10-FEB 28	10		57-58	NOV 28-JAN 25	8	
89-90	NOV 11-FEB 28	10		56-57	NOV 22-JAN 25	8	
88-89	NOV 12-FEB 28	10		55-56	NOV 24-JAN 25	8	
87-88	NOV 14-FEB 29	10		54-55	NOV 25-JAN 25	6	
86-87	NOV 8-FEB 28	10		53-54	NOV 26-JAN 15	6	
85-86	NOV 9-FEB 28	10		52-53	NOV 27-JAN 25	8	
84-85	NOV 10-FEB 28	10		51-52	NOV 22-JAN 25	8	
83-84	NOV 12-FEB 29	10		50-51	NOV 25-JAN 25	8	
82-83	NOV 13-FEB 28	10		49-50	NOV 24-JAN 25	8	
81-82	NOV 14-FEB 28	10		48-49	DEC 1-FEB 1	10	
80-81	NOV 8-FEB 28	10		47-48	DEC 1-FEB 1	10	
79-80	NOV 10-FEB 29	10		46-47	*		
78-79	NOV 11-FEB 28	10		45-46	NOV 25-JAN 25	10	
77-78	NOV 12-FEB 28	10		44-45	*		
76-77	NOV 13-FEB 28	10		43-44	NOV 25-JAN 25	10	
75-76	NOV 1-FEB 29	10		42-43	NOV 25-JAN 25	10	
74-75	NOV 28-MAR 1	10		41-42	NOV 25-JAN 25	10	
73-74	NOV 22-FEB 23	10		40-41	NOV 25-JAN 25	12	
72-73	NOV 18-FEB 10	10					
71-72	NOV 6-FEB 12	8					
70-71	NOV 26-FEB 15	8					

ZONE 1-SMALL GAME HUNTING CLOSED IN COUNTIES
OPEN TO DEER HUNTING ON DAYS DEER HUNTING
PERMITTED

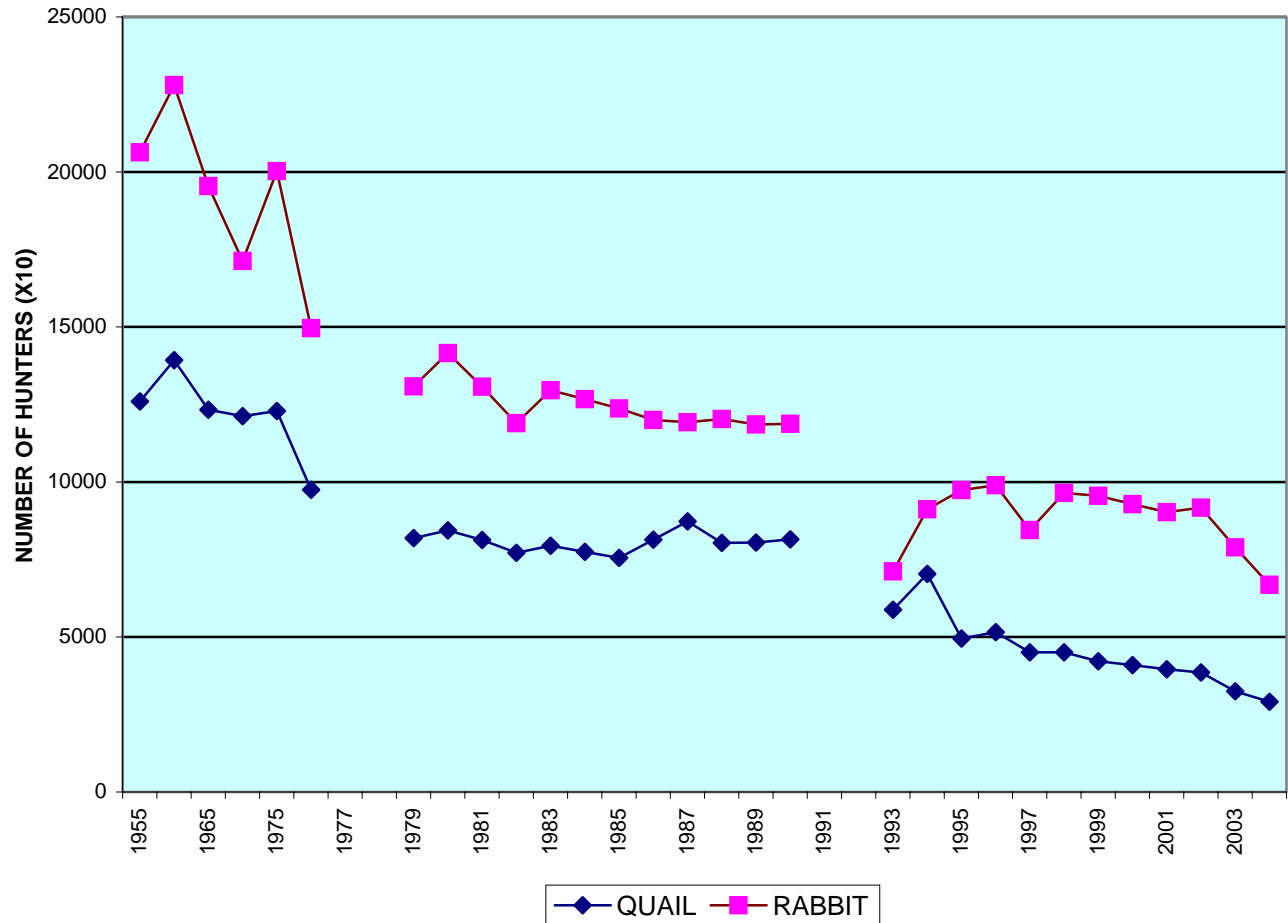
TENNESSEE RABBIT HUNTING SEASONS, 1945-2004

YEAR	SEASON DATES	BAG LIMIT	COMMENTS	YEAR	SEASON DATES	BAG LIMIT	COMMENTS
03-04	NOV8-FEB 28	5		70-71	NOV 26-FEB 15	5	ZONE 1 SMALL GAME HUNTING CLOSED IN COs. OPEN TO DEER HUNTING ON DAYS DEER HUNTING PERMITTED
02-03	NOV 9-FEB 28	5					
01-02	NOV 10-FEB 28	5					
00-01	NOV 11-FEB 28	5					
99-00	NOV 13-FEB 28	5					
98-99	NOV 14-FEB 28	5		69-70	NOV 17-FEB 15	5	
97-98	NOV 8-FEB 28	5		68-69	NOV 18-FEB 15	5	
96-97	NOV 9-FEB 28	5		67-68	NOV 20-FEB 15	5	
95-96	NOV 11-FEB 29	5		66-67	NOV 21-FEB 15	5	
94-95	NOV 12-FEB 28	5		65-66	NOV 22-FEB 5	5	
93-94	NOV 13-FEB 28	5		64-65	NOV 23-FEB 20	5	
92-93	NOV 14-FEB 28	5		63-64	NOV 18-JAN 25	5	
91-92	NOV 9-FEB 29	5		62-63	NOV 19-JAN 25	5	
90-91	NOV 10-FEB 28	5		61-62	NOV 20-JAN 25	5	
89-90	NOV 11-FEB 28	5		60-61	NOV 21-JAN 25	5	
88-89	NOV 12-FEB 28	5		59-60	NOV 27-JAN 25	5	
87-88	NOV 14-FEB 29	5		58-59	NOV 27-JAN 25	5	
86-87	NOV 8-FEB 28	5		57-58	NOV 28-JAN 25	5	
85-86	NOV 9-FEB 28	5		56-57	NOV 22-JAN 25	5	
84-85	NOV10-FEB28	5		55-56	NOV 24-JAN 25	5	
83-84	NOV 12-FEB 29	5		54-55	NOV 25-JAN 25	5	
82-83	NOV 13-FEB 28	5		53-54	NOV 26-JAN 15	5	
81-82	NOV 14-FEB 28	5					NO CLOSED SEASON IN CROCKETT CO. NO CLOSED SEASON IN CROCKETT CO. MAY BE TRAPPED BUT NOT SOLD MAY BE TRAPPED BUT NOT SOLD
80-81	NOV 8-FEB 28	5		52-53	NOV 27-JAN 25	5	
79-80	NOV 10-FEB 29	5					
78-79	NOV 11-FEB 28	5		51-52	NOV 22-JAN 25	5	
77-78	NOV 12-FEB 28	5					
76-77	NOV 13-FEB 28	5		50-51	NOV 25-JAN 25	5	
75-76	NOV 1-FEB 29	5					
74-75	NOV 28-MAR 1	5		49-50	NOV 24-JAN 25	5	
73-74	NOV 22-FEB 23	5		48-49	DEC 1-FEB 1	5	
72-73	NOV 18-FEB 10	5		47-48	NOV 27-FEB 1	5	
71-72	NOV 6-FEB 12	5		46-47	*		
				45-46	NOV 25-JAN 25	5	

*No season dates listed does not mean that there was not a rabbit season that year,
only that a record of that year's season has not been located yet.

Table 3

Number of Rabbit and Quail Hunters 1955-2004



CURRENT AND PROJECTED STATUS

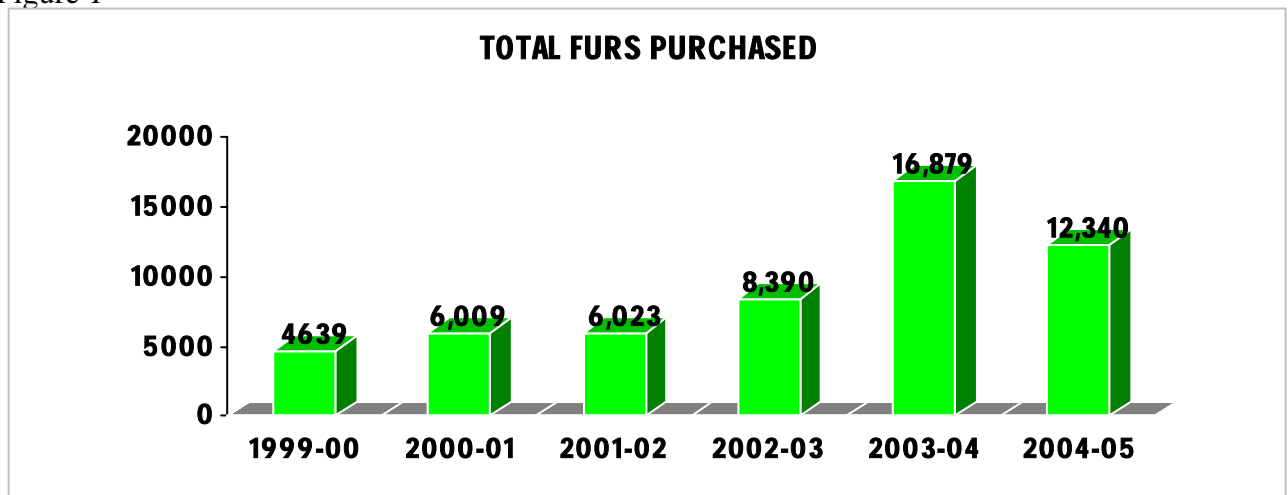
By state statute, the Tennessee Wildlife Resources Agency (TWRA) is responsible for the preservation and development of all wildlife species' programs across the state. Among these are the furbearers, which includes 14 species: beaver (*Castor canadensis*), bobcat (*Lynx rufus*), coyote (*Canis latrans*), gray fox (*Urocyon cinereoargenteus*), red fox (*Vulpes vulpes*), mink (*Mustela vison*), muskrat (*Ondatra zibethicus*), opossum (*Didelphis virginiana*), river otter (*Lutra canadensis*), raccoon (*Procyon lotor*), striped skunk (*Mephitis mephitis*), spotted skunk (*Spilogale putorius*), long-tailed weasel (*Mustela frenata*), and least weasel (*Mustela nivalis*).

The river otter, formerly a threatened species over the eastern two-thirds of the state was de-listed and is currently classified as a game species.

The fisher (*Martes pennanti*) is a species that once ranged down the Appalachians into Tennessee. Reintroduction of the fisher began in 2001-2002 on the Catoosa Wildlife Management Area. Populations are currently being monitored to determine feasibility of continuing reintroduction efforts.

Because of increased demand for otter and bobcats, trapping for these species has increased somewhat since 1999 (Figure 1). Some furbearer populations are increasing and are under harvested. In addition, increasing urbanization is causing and will continue to cause more complaints about nuisance animals. In some areas distemper outbreaks have been recorded and raccoon rabies is now endemic in East Tennessee.

Figure 1

PAST, PRESENT, AND FUTURE USE

Furbearer populations are among the most abundant wildlife resources in Tennessee, and hunting and trapping are vital management tools. The fur trade has been a viable industry in the state for over 200 years. Traditionally, it has been characterized by frequent "ups and downs" in fur prices, depending on the popularity of fur in fashion. In Tennessee the

number of trappers and hunters, who take fur, have also fluctuated with fur prices and we are currently experiencing a slight increase in price and demand, (Figure 1).

The numbers of furbearing animals harvested in Tennessee have varied, for the most part, with fluctuating prices. From the 1950s to the early '70s Tennessee furs added an average of around \$225,000 to Tennessee's economy. The fur industry "boomed" from the late '70s to 1985/86. At that time the state's fur harvest fluctuated between 84,000 and 178,000. These high harvests were undoubtedly due to marked increases in the prices of pelts. The dollar value for furs peaked at nearly \$2.5 million in 1978/79. From 1986 to 1992 fur prices dropped precipitously and pelt sales plummeted from nearly 126,000 in 1986/87 to a low of 4,839 in 1999/00. There has been a slight increase in sales since the 1999 season, with a high of 16,879 pelts sold in 2003/04 (Figure 1).

Regulating harvest has proven difficult for some species such as the raccoon, while other species have been consistently underutilized. Federal regulations, resulting from international treaties, have placed restrictions on the sale of some furs whose populations are not in jeopardy.

The TWRA has attempted to develop fur regulations for a number of species with different habits, taken by a variety of hunters and trappers, who are sometimes in conflict with each other. The success of these regulations has varied with pelt prices, population levels, hunter and trapper preferences, and weather. With species such as the raccoon, management becomes more complex when species density varies dramatically between physiographic regions (Minser and Pelton 1982) and is further complicated by the occurrence in 2003 of raccoon rabies. The political influence of hunters and trappers can further influence regulations.

Significant analyses of populations, habitats and harvests are not possible until more adequate information is obtained. Fur-harvest records have proved helpful in giving an index of harvest trends. Demands have fluctuated primarily in response to conditions in the fur market rather than to established season lengths. The instability of the market prevents any reasonable projections of demand. In years of depressed prices, the furbearer resources have probably been under harvested.

As the commercial demand for fur has declined significantly since 1987, the numbers of nuisance complaints have increased. Since 1989, over 100 private animal damage control operators have been licensed in the state. These operators mainly control beaver, raccoons, opossums, skunks, foxes, and coyotes. It appears that controlling nuisance furbearers may be the most profitable pursuit for consumptive users of this resource in the foreseeable future. The low demand for fur will likely continue through the duration of this plan. Nuisance control is likely to increase through the duration of this plan. Nuisance control efforts have been complicated by the appearance of raccoon rabies in East Tennessee. The Agency should take a closer look at both the benefits and problems associated with this growing enterprise.

For the next 15 years public use of the furbearer resource is expected to remain about the same, but is subject to dramatic changes if fur prices change.

GOALS

1. To protect and manage furbearers for all users.
2. Develop methods to address real or perceived conflicts caused by some species.

OBJECTIVES

1. Determine number and types of users of furbearer resources in 2006-2007 and maintain or increase those numbers by 2011.
2. Improve the number of Animal Damage Control Permit holders to a level averaging 1 permittee per 3 counties.

OPPORTUNITIES, PROBLEMS, ISSUES, AND STRATEGIES

I. Problem: Unfavorable publicity has harmed the image of the fur industry.

Strategies

1. Develop and implement a trapper education program that will qualify graduates for ADC permit.
2. Develop training and nuisance wildlife control manuals and workshops for teaching landowners how to handle wildlife damage.
Promote the fur industry through I&E and marketing efforts; consider establishing a Southeastern Fur Auction in Tennessee.

II. Problem: Increasing urbanization and declining fur harvest have resulted in expanding populations of some species and increases in human-wildlife conflicts.

Strategies

1. Increase consumptive utilization of urban fur populations by improving TWRA's animal damage control program and increasing the number of qualified ADC agents.
2. Seek additional resources to deal with high profile wildlife problems e.g. sick or injured wildlife; wildlife officers should be excluded from dealing with diseases that pose a human health hazard.
3. Develop procedures and policies for dealing with diseased wildlife.
4. Seek avenues to improve hunting opportunity for raccoon and fox hunters e.g. buying land for public hunting.

III. Problem: Trends in fur populations are not reflected in fur dealer reports.

Strategies

1. Initiate procedure to record raccoon field trial data.
2. Use ADC reports to document trends in urban areas.
3. Develop a nighttime furbearer count.
4. Encourage reporting of weasel, spotted skunk, otter and bobcat sightings by TWRA personnel, and record reliable reports of these species from public sources.
5. Develop methodology to census fur users via internet surveys or other inexpensive means.

IV. Problem: The fisher has been extirpated in areas they formerly occupied.

Strategies

1. Continue restoration of the fisher where feasible.
2. Monitor existing fisher population to determine reproductive success, improve food habit data, and spatial dispersal.

V. Problem: Existing laws unreasonably restrict utilization of the fur resource.

Strategies

1. Legalize snares statewide.
2. Clarify TWRA interpretations of laws and regulations relating to trapping; such as, setting conibear traps above ground, policies on damage control, etc.

METHODS

The TWRA is presently monitoring fur harvests through fur dealer transactions. Data obtained from the dealers does not reflect total harvest but does show trends on the demand for the resource.

The TWRA maintains records on the number of licensed trappers, fur dealers, numbers and kinds of animals taken, value of pelts and total value of the annual fur harvest. Fur sales in Tennessee are determined annually from records kept by licensed fur dealers. Section 70-4-218 of Tennessee Code Annotated (TCA) requires every fur dealer to file a complete report listing names and addresses of sellers, kinds and numbers of furs bought, county where taken, license type of seller, and dates of purchases made during the preceding month. The report must be filed monthly with the TWRA October through March no later than the 10th day of each month.

The furs reported represent the minimum numbers of pelts marketed in Tennessee. Those sold out-of-state are not included in the totals; however, pelts coming into Tennessee are recorded. Presently there is no way to measure the "out-of-state" sales, but it is believed that the majority are sold to Tennessee fur dealers.

In addition, the number of trapping licenses sold annually is less than the actual number of trappers because Tennessee law excludes from the license requirement juveniles under 13, and landowners trapping on their own land. Additionally, sportsman license, lifetime license, and senior citizens license holders are also allowed to trap, but no records are available on the percentage of those license holders who trap.

The TWRA has had numerous research contracts with University of Memphis, Tennessee Tech University and the University of Tennessee to develop reliable census techniques to monitor raccoon populations. Results of these investigations have been mixed, depending on the density of the population and the habitat type censused. Nine technical reports have been published on various scent post evaluations for raccoon. The Agency plans to investigate other methods to census and monitor furbearer populations such as stream float surveys and spotlight counts.

The Agency is using a phone survey to gather harvest data for all game. The data obtained can be used to supplement fur dealer reports especially during years of low fur prices. Results of the surveys will provide guidance in making management decisions.

The goals and objectives for the management of Tennessee's furbearers were determined by a committee of Agency personnel. These personnel each had a background in furbearer management and/or the administration of Agency programs. This committee represented different regions of the state and brought different areas of expertise into the formulation of the management strategies. Committee members represented the interests of furbearer biologists, law enforcement, information and education, and administration. Each of these groups will be intimately involved with the future of Tennessee's furbearers.

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Furbearer Plan Committee

Bruce Anderson, Region 3, Chairman
Cape Taylor, Region 2
Chuck Borum, Region 2
Jeff Pearce, Region 4
Jim Hamlington, Region 1
Randy Huskey, Fur Coordinator, Nashville

CURRENT AND PROJECTED STATUS

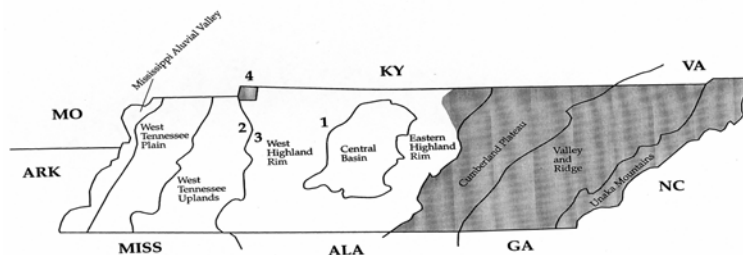
Ruffed grouse (*Bonasa umbellus*) belong to the family Tetraonidae, which includes nine other species of grouse native to North America.

Ruffed grouse are the size of small chickens and possess a large fanlike tail and two patches of iridescent black or dark brown neck feathers called a ruff. Two distinct color phases exist depending upon geographic location. Variations of gray predominate in colder northern and western regions of the range, and reddish brown predominates in the southern regions. These colors overlap geographically, and both gray and red phase grouse inhabit the northeastern United States. Only the red phase is found in Tennessee.

Ruffed grouse are non-migratory and spend their entire lives in or near forested areas. They are present in all of the Canadian Provinces and in thirty-eight of our more northern and eastern states-occupying, with wild turkey, a range larger than that of other non-migratory game birds native to North America.

Tennessee is near the southern extreme of ruffed grouse range in North America. Grouse are found in the eastern one-third of the state, closely coinciding with the portion of the Appalachian Mountain Bird Conservation Region in Tennessee. The western boundary is roughly approximate with the western edge of the Cumberland Plateau (Figure 14-1) (Johnsgard 1983, White and Dimmick 1979). Historical records refer to the presence of grouse in Tennessee as far west as the Western Highland Rim (Schultz 1953, White and Dimmick 1979).

Figure 1. Current range of ruffed grouse in Tennessee.



Regardless of the locale, ruffed grouse are highly dependent on early successional forest stages, which provide quality brood habitat and protective winter escape cover (Boyd 1990, Dimmick et al. 1998, Epperson 1988, Gudlin 1984, Kalla 1991, Longwitz 1985, Pelren 1991, Thompson and Dessecker 1997). Grouse in the Appalachian Mountains also utilize mature hardwood-conifer forests, but primarily where there is a significant understory of mountain laurel (*Kalmia latifolia*), rhododendron (*Rhododendron* spp.) or other shrub and vine thickets to provide critical protective understory cover on an otherwise bare winter landscape (Dimmick et al. 1998).

The ecology of Appalachian grouse of the mid-South differs some from most northern populations. Populations do not seem to exhibit the regular ten-year fluctuation cycle. Diets consist of fewer nutritious foods (Servello and Kirkpatrick, 1987) and reproductive

recruitment and spring-to-fall survival is lower. Overall population densities are typically much lower than northern populations most years.

PAST, PRESENT, AND FUTURE USE

Little information was known about grouse populations in Tennessee prior to the 1960s. At this time the bobwhite quail was considered the absolute king of the upland game birds in the South, and only a few locals hunted the grouse. Therefore, little emphasis was placed at that time on grouse in Tennessee by wildlife professionals and the hunting public. Tennessee Game and Fish Commission data indicated the level of grouse hunting success remained relatively stable from 1951 through the 1960s (Table 1).

Partly influenced by declining bobwhite populations, interest in ruffed grouse increased in the 1970's. Studies were conducted on the grouse and its habitats from the late 1970's to the mid-1990's. The highest grouse populations tend to occur in the eastern mountains and rugged, upland ridges of the East Tennessee Valley, which are characterized by overstories of oak, hickory and beech, with thick understories of rhododendron, mountain laurel and grape. In the East Tennessee Valley, grouse are also found along wooded edges of the ridge and Valley farmland, and the thick cedar-scrub country that occurs around the Valley's numerous limestone outcroppings.

The habitat changes occurring in the early 1900's that eliminated the grouse from much of western and middle Tennessee have, in some cases, been reversed. These changes, mainly the reversion of abandoned farmland to upland hardwood forest types with an associated understory of laurel, recovered to the point where it was believed that grouse could be successfully reintroduced into some areas. Restoration attempts were made on the Cheatham Wildlife Management Area (WMA) in middle Tennessee (Jones 1979), and the Nathan B. Forrest State Historical Area/WMA in Benton County (White 1978) in the late 1970's. Located on the Western Highland Rim, these areas consist of densely wooded rolling hills very similar to habitat supporting ruffed grouse populations in the eastern ridge and valley sections of East Tennessee. Results from these stockings merited further experimental releases on Nathan B. Forrest S.H.A./WMA (Gudlin 1984) and in the Cuba Landing area of Humphreys County in the early 1980's (Kalla 1987). These grouse reintroductions have not been successful enough over time to warrant further efforts.

Overall forest cover in Tennessee grouse range has remained fairly constant over the last several decades. However, losses in grouse habitat have occurred where large-scale strip mining have removed forest cover, and where commercial timber companies have made large scale conversions from hardwoods to dense monoculture pine stands. Significant loss of habitat is also occurring in the 625,000-acre Cherokee National Forest as timber harvest has declined and the amount of forest classes under 20 years of age continue to decline (U. S. Forest Service inventory data). In addition, as the human population and resulting urbanization continue to expand, grouse habitat is impacted through the spread of residences in woodland areas, which typically results in protection of woodlands from

periodic timber harvest, and removal of viny understory cover in efforts to “clean up” the area. In many instances, these areas are also lost to hunting access.

Environmentally damaging, large-scale (several hundred to a thousand or more acres) clearcuts in South America, the northwestern United States, and occasionally in the Southeast, have negatively influenced reactions by a segment of the public against even-aged forest management. As a result, a marked decline in recruitment of early successional hardwood forest has been taking place over the last two decades. Forest Inventory Analysis data (U.S. Forest Service 2002) indicates a 41% decline in seedling/sapling habitat in the Tennessee portion of the Appalachian Mountains Bird Conservation Region from 1989-2002.

The recently completed Appalachian Cooperative Grouse Research Project (Norman et al. 2004) involving six Southern Appalachian states has provided further insight into the ecology of ruffed grouse outside the range of the quaking aspen (*Populus tremuloides*), with which northern grouse are so closely associated. In Tennessee, grouse management will revolve around the management of hardwood forests and associated openings. In great contrast to the aforementioned examples, clearcutting as practiced by Tennessee state government agencies are restricted to cuts of 30 acres or less, are limited to 40 acres or less on the Cherokee National Forest, and are mandated on both to be conducted in accordance to forestry Best Management Practices. On hardwood sites, the goal is to restore and/or improve the subsequent hardwood forest that will develop following the harvest and regeneration, and to provide wildlife habitat diversity. Small scale clearcuts and similar even-aged timber management are almost always the most cost-effective means of timber harvest, and are often necessary to ensure regeneration of mast-producing hardwoods such as oaks (Beck 1988, Kellison 1982, McGee 1967, Thompson and Dessecker 1997). Proper vegetation establishment and management on logging roads and small forest openings can also greatly enhance brood-rearing habitat (Harper et al., in press).

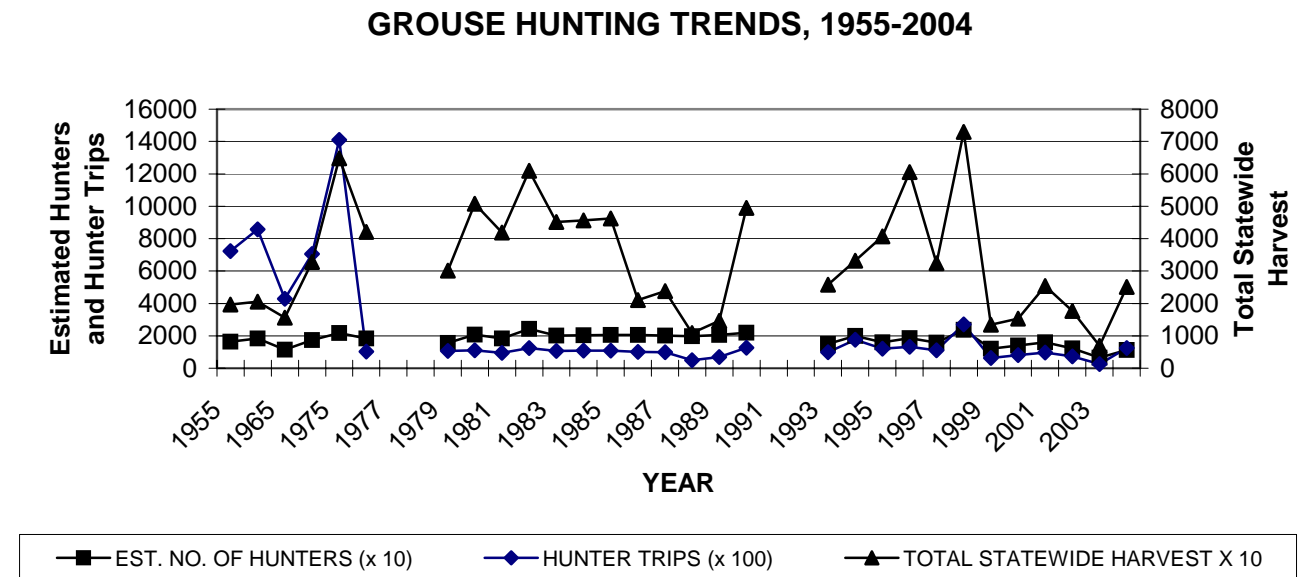
There is some public opposition to the use of clearcutting in any form. However even-aged timber harvests are used by professional foresters and wildlife managers on public lands in the eastern United States as a means to provide quality hardwood regeneration in an economical manner, and to provide the biological diversity needed to also sustain other wildlife species dependent upon young forest habitats (Klaus 1999). The elimination of small-scale clearcutting as a silvicultural tool will result in the reduction of early successional hardwood forests, and in turn, will most likely result in decreased Tennessee ruffed grouse populations.

Public lands comprise a significant portion of the of the grouse’s range in Tennessee. Reflective of this, approximately 60% of reported annual hunter trips are on public lands (TWRA Small Game Harvest Reports, 2002-03 and 2003-04). The Cherokee National Forest (CNF) comprises approximately 60% of the public land available to grouse hunting in TWRA Regions 3 and 4. The Catoosa/Mt. Roosevelt, Sundquist and Royal Blue WMAs and the Big South Fork National River and Recreation Area comprise a significant portion of the remaining public lands available to grouse hunting. Also, the

Sundquist WMA was acquired in 2003 and consists of 73,000 acres in Anderson, Campbell and Scott counties. While TWRA owns the land, a private timber investment management organization owns the timber rights. The timber is managed by Fountain Forestry according to guidelines established by the Sustainable Forestry Initiative, with input provided by TWRA. Thus, while there are no specific objectives identified for Sundquist WMA in this plan, the level of forest management and harvest methods should enable Sundquist WMA to continue to be one of TWRA's better management areas for ruffed grouse and other wildlife dependent upon early successional forests.

Currently, demand exceeds supply and this will likely remain true for at least the next 15 years. Grouse hunter numbers and harvest appear to be declining (Table 1 and Figure 2) as ruffed grouse populations decline. Higher grouse populations and hunting access to these populations would likely stimulate an upswing in hunter interest, as hunters search for quality upland bird hunting opportunities in the Southeast.

Figure 2.



Due to sheer acreage, whatever happens on CNF forest management will greatly influence grouse hunting trends in Tennessee. Accordingly, TWRA must still strive to influence development of good grouse habitat on the CNF. However, TWRA still has significant acreage of forested WMAs that could be managed much more intensively and intentionally for ruffed grouse and other species of concern that utilize the same habitats, such as the golden-winged warbler (*Vermivora chrysoptera*). Acquisition of the Sundquist and Foothills WMAs during this last Strategic Plan cycle brought a sizeable amount of existing or potential grouse habitat into TWRA ownership. By increasing the carrying capacity of habitat on TWRA lands and monitoring populations, the Agency should be able to make strides towards accomplishing that goal.

Efforts to influence grouse habitat on private lands will be linked to the ability to maintain clearcutting as a hardwood management tool, and utilizing state and federal conservation programs to promote healthy and diverse forests.

GOAL

The goal of the grouse program is to increase ruffed grouse populations by increasing the quantity and quality of available habitats, and increase hunter participation and success.

OBJECTIVES

1. Maintain an annual average of 92,000 hunter trips for 11,000 grouse hunters.
2. Maintain an average of .75 flushes per party hour.
3. Achieve a long-term (beyond this Strategic Plan cycle) objective of maintaining 10% of forested public lands acreage in the Appalachian Mountains Bird Conservation Region (BCR) in the 0-10 year age class.
4. Regenerate at least 400 acres per year of forest on Catoosa/Mt. Roosevelt WMAs, 300 acres per year on Royal Blue WMA, and 50 acres per year on Foothills WMA, through even-aged management (clearcuts, appropriate modified shelterwood cuts, etc.).

PROBLEMS, OPPORTUNITIES, AND STRATEGIES

I. Problem: Lack of quality grouse habitat on forested public lands in the Appalachian Mountain BCR.

Strategies

1. Coordinate TWRA efforts in the development and implementation of the North American Ruffed Grouse Conservation Plan.
2. Continue to provide input and recommendations in the Cherokee National Forest planning processes, addressing such problems as severely declining early successional forest habitat, logging road seedings, daylighting of gated roads, and categorical exclusions for some management practices. Strive towards a goal on the Cherokee National Forest to establish and maintain 5% of the forested area in 0-10 year age class.
3. Support legislation to make it more difficult for litigation to halt scientifically supported forest management activities on public lands.
4. Revise standard logging road daylighting and seeding standards. On seeding recommendations, remove the use of orchard grass and substitute wheat and clover, and revise any other existing seedings that could be more wildlife-friendly.
5. Seek grants or other non-Agency funding to contract necessary manpower to implement identified grouse management actions where TWRA manpower is a limiting factor.

II. Problem: Some public opposition to timber harvest, particularly clearcutting, threatens to politically preclude proper forest management on State and private lands.

Strategies

1. Distribute information (e.g. publication, “Managing Your Oak Forests For Ruffed Grouse – Wildlife Diversity Through Forest Management”) as appropriate to legislators and the public.
2. Seek/support legislation to require the use of Best Management Practices on private land.
3. Incorporate forest management information to youth in such programs as Project WILD and Project Learning Tree.
4. Erect signs on Royal Blue, Sundquist, and other WMAs on key sites explaining forest management for early successional forest wildlife species.

III. Problem: There are technical and financial assistance obstacles for landowners to incorporate forest management practices.

Strategies

1. Continue to work with the Southeast Forestry and Wildlife Working Group to develop a “Wildlife Woodlands” type program and/or provide modifications and increased funding in existing USDA programs such as Forest Stewardship and Forest Lands Enhancement Program.
2. Provide input to USDA in the development of the 2007 Farm Bill regarding the need for technical and financial assistance programs to encourage good forest management for early successional wildlife species.
3. Develop and distribute good technical assistance information to private landowners on managing habitats for ruffed grouse.
4. Increase the number of field biologists available to write Forest Stewardship plans, and/or cooperate with Tennessee Division of Forestry to sufficiently incorporate wildlife concerns or oversight on forest plans written for landowners who have a wildlife interest.
5. Explore tax incentives that would encourage private landowners to manage their forests for wildlife.

IV. Problem: Decreasing hunter access for grouse hunting.

Strategies

1. Take advantage of land acquisition initiatives to acquire good forest lands as WMAs.
2. Explore avenues to connect landowners looking to lease their land for hunting with small game hunters seeking to lease land.
3. Make available information on the TWRA website and other sources so that hunters can learn about grouse hunting opportunities on public lands.

V. Problem: Lack of data to adequately monitor grouse populations.

Strategies

1. Assimilate a ruffed grouse brood survey into the existing TWRA turkey brood survey in those counties east of I-65.
2. Initiate a grouse drumming survey on landscapes that include selected WMAs, national forest, and other important lands (both public and private), incorporating volunteer participation from Ruffed Grouse Society members and other grouse hunters.
3. Support and/or fund appropriate grouse research projects that will promote the scientific basis for interpreting population trends.

VI. Opportunity: The anticipated increase in coal mining will offer future opportunities to reclaim minelands to good grouse habitat.

Strategies

1. Participate in actions resulting from 2005 Mineland Summit to provide and incorporate reclamation guidelines and practices that will benefit grouse.

VII. Opportunity: Grouse management is concurrent management for other early successional game and nongame species.

Strategies

1. Support efforts to increase forest habitat for golden-winged warblers and other nongame species associated with similar habitats (e.g. Partners In Flight, Joint Venture plans, etc.)
2. In grouse information venues, include information on how grouse management benefits other wildlife species.

METHODS

Projections for objectives were based on what could realistically be expected if the Ruffed Grouse Program is successful in slightly increasing hunter numbers (as identified in the Program Goal). Objective harvest rates were established at a level consistent with past harvest success rates in years of moderate to good grouse abundance. Yearly grouse populations are highly influenced by weather extremes and/or unexplained cycles. Thus, such extremes may cause populations to decline even in the presence of the best management programs; but good management should, over time, maintain populations at higher levels than if little or no management were done.

The Ruffed Grouse Program was developed by the members listed: Mark Gudlin (Committee Chair) TWRA Private Lands Liaison; Brant Miller, TWRA Staff Forester; Billy Swafford, TWRA Region 3 Forest Stewardship Biologist; Ron Saunders, TWRA Region 4 Lands Management Biologist; Dr. Craig Harper, UT Wildlife Extension Specialist; Mark Banker, Ruffed Grouse Society Regional Biologist; and Benjamin Jones, ACGRP Research Student. Past accomplishments (TWRA Progress Reports for Small Game, July 1, 2000 - June 30, 2006) and the

likelihood for success of proposed strategies were discussed and analyzed to determine appropriateness and priority of proposed problems and strategies.

Table 1. Ruffed Grouse Hunting in Tennessee. 1951-2003.

SEASON	USERS	TRIPS	HARVEST
1951-52	16,451	72,384	19,648
1955-56	18,308	85,826	20,585
1960-61	11,404	42,923	15,658
1965-66	17,390	70,516	32,758
1970-71	21,745	140,958	64,766
1975-76	18,301	102,571	48,124
1978-79	15,544	100,149	50,080
1979-80	20,789	110,591	50,728
1980-81	18,317	94,109	41,900
1981-82	24,200	184,538	60,922
1982-83	20,172	107,456	45,095
1983-84	20,315	108,393	45,662
1984-85	20,458	109,330	46,230
1985-86	20,476	100,332	22,073
1986-87	20,209	99,024	21,785
1987-88	19,690	49,255	10,830
1988-89	20,507	69,724	14,642
1989-90	21,844	126,927	49,507
*1992-93	15,009	99,059	25,755
1993-94	19,876	174,909	33,233
1994-95	15,969	119,768	40,721
1995-96	18,525	131,528	60,503
1996-97	15,717	111,591	32,361
1997-98	23,727	270,488	73,023
1998-99	12,313	64,028	13,466
1999-00	No data available		
2000-01	16,001	97,606	25,377
2001-02	12,296	73,776	17,706
2002-03	6,553	25,558	6,901
2003-04	11,279	125,197	25,039

* All figures prior to 1992 were derived from TWRA's Annual Mail Survey, which was discontinued after 1989-90 season. The 1992-93 season estimate was determined from a telephone survey conducted by the University of Tennessee under contract to the Tennessee Wildlife Resources Agency.

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CURRENT AND PROJECTED STATUS

Tennessee's wildlife is incredibly diverse. The state is home to almost 1400 species of vertebrates (animals with backbones), such as fish, amphibians, reptiles, birds, mammals and invertebrates (animals without backbones) such as crayfish, land snails, aquatic snails, freshwater mussels and fingernail clams.

This great diversity of species is supported by a wide array of habitats. Terrestrial habitats range from the wetlands and bottomland hardwoods of western Tennessee, cedar glade and grassland habitats of middle Tennessee and the spruce-fir forests of the mountainous east. The Mississippi River Valley is the pathway of one of the largest avian migrations in North America. The majority of the reptilian diversity is concentrated in western Tennessee, while amphibian diversity is greatest in the east. The Unaka Mountains provide habitats for extremely rich salamander diversity.

Bisecting Tennessee's landscapes are streams and rivers of five major river systems. The Mississippi River and its tributaries drain the western portions of the state. The Cumberland and Tennessee Rivers and their tributaries drain the majority of the remaining area of the state. Tributaries of the Barren River, which flows into the Ohio River, drain a portion of northern middle Tennessee, near Kentucky. The Conasauga River drains a small portion of southeast Tennessee and flows into the Mobile Basin and eventually into the Gulf of Mexico

Aquatic environments range from the oxbows and sloughs of the Mississippi River to the subterranean and spring habitats of the Middle Tennessee Barrens and Cumberland Plateau to the cold mountain streams of the eastern mountains. This diversity of aquatic habitats supports an unparalleled array of aquatic species. Seventy-six species of crayfish, 98 species of aquatic snails, 130 species of freshwater mussels and over 325 species of fish can all be found within Tennessee.

The Tennessee Wildlife Resources Agency (TWRA), has the statutory responsibility for wildlife and their habitats within the state. Wildlife is defined in T. C. A. 70-1-101 as wild vertebrates, mollusks, crustaceans, and fish. Further, in T. C. A. 70-8-103, nongame wildlife is defined as any wild mammal, bird, amphibian, reptile, fish, mollusk, crustacean or other wildlife not ordinarily taken for sport, fur, food or other commercial use.

Tennessee Code Annotated 70-8-102 declares the policy of this state to manage certain nongame wildlife to ensure their perpetuation as members of ecosystems, for scientific purposes, and for human enjoyment. Further, T. C. A. 70-8-104 calls for "investigation on nongame wildlife in order to develop information relating to population, distribution, habitat, needs, limiting factors, and other biological and ecological data to determine management measures necessary for their continued ability to sustain themselves successfully."

STRATEGIC PLAN 2006 - 2012 NONGAME & ENDANGERED SPECIES

Additionally, as a subset of nongame species are the Wildlife in Need of Management, Threatened and Endangered species. Tennessee Code Annotated 70-8-104 and 70-8-105 requires identification of wildlife in need of management (NOM), threatened (T) and endangered (E) species. These legal designations are also defined in T. C. A. 70-8-103 (Appendix A).

Nongame and Endangered Species Program (NGESP)

Program activities include providing technical assistance and management planning with public and private landowners. Personnel monitor rare wildlife (i.e. Bald Eagle nest counts), conduct bird inventories (i.e. point-counts), fish and mussel surveys, develop rare species lists (Endangered, Threatened and Wildlife in Need of Management), develop Wildlife Viewing Areas, inspect wildlife rehabilitators and wildlife education facilities and review and issue scientific collectors and falconry permits. Program objectives are also forwarded through partnerships with other organizations. Administration and coordination with academic institutions, governmental agencies and nongovernmental organizations conducting research, species inventories and habitat or populations surveys provide the program with additional data.

PAST, PRESENT AND FUTURE USE

Past

Throughout the years, funding for the NGESP has been dependent on state legislative appropriations, federal funds and state wildlife funds (hunting and fishing license revenue). State legislative appropriations for the NGESP began in 1979. The annual appropriation varied considerably during the period appropriations were received (Table 1.).

The Nongame and Endangered Species Program also receives federal funds through the Endangered Species Act allocated by the U. S. Fish and Wildlife. This funding, though consistent annually, also varies in amounts.

Table 1. Year and amount of state general fund appropriations allocated to the NGESP. Appropriations from the state general fund were discontinued in 1991. * In 1994-95 the legislature appropriated funds from the TWRA wildlife fund to the Nongame and Endangered Species Program.

<u>Year</u>	<u>Amount</u>
1979-80	\$ 42,000
1980-81	\$ 87,000
1981-85	\$ 46,000
1985-87	\$151,000
1987-91	\$100,000
1991-94	\$ 0
1994-95	\$100,000*
1995- 2005	\$ 0

TWRA Wildlife funds have been necessary to maintain the NGESP throughout its existence. Without a consistent increase in funding the nongame program could not intensively plan or expand activities.

Early in the 1990's, there was a nationwide realization that states needed consistent federal funding for the conservation and management of nongame species. This funding needed to be modeled similar to the federal funding state agencies received to manage game species and sportfish. Throughout the decade of the 90s, more than 3000 groups came together in a nationwide initiative called Teaming With Wildlife (TWW). This coalition included wildlife managers, conservationists, hunters and anglers, businesses, and many others who supported the goal of restoring and conserving our nation's wildlife. An excise tax on outdoor recreation equipment was proposed. Re-distributed to the states, an estimated \$350 million in tax revenue, could be used for such projects as habitat acquisition, construction of wildlife viewing areas, and restoration and management of wetlands, bottomland hardwood reforestation, propagation of rare species, species inventories, monitoring and others.

However, TWW could not garner enough momentum to overcome anti-tax sentiments. To that end, the initiative re-grouped and proposed the Conservation and Re-investment Act or CARA. CARA re-directed royalties from outer-continental shelf oil production to state wildlife agencies for fish and wildlife conservation, conservation education, wildlife related recreation, coastal conservation and impact assistance. In 2000, CARA passed the House of Representatives and the Senate Committee on Energy and Natural Resources. It, however, was never brought to the full Senate for a vote. CARA, so close to passing, stalled. Congressional supporters quickly introduced the Wildlife Conservation and Restoration Act.

Present Use

In 2001, Congress passed the Wildlife Conservation and Restoration Act (WCRP) appropriating \$50 million nationwide. Tennessee's appropriation equaled \$838,000 (Table 2). This funding required a 25% match. The NGESP met this match through in-kind services and overhead, as well as partnerships with nongovernmental organizations. In succeeding years the TWRA has received additional federal nongame funding under the State Wildlife Grants Program (SWG). However, State Wildlife Grants require a 25% match for planning activities and 50% match for implementation activities. Both the WCRP and the SWG require states to develop a Comprehensive Wildlife Conservation Strategy (CWCS). Tennessee's CWCS was submitted to the U. S. Fish and Wildlife Service on September 30, 2005.

STRATEGIC PLAN 2006 - 2012 NONGAME & ENDANGERED SPECIES

Table 2. Approximate funding allocated nationwide and to Tennessee during 2001-2005.

Year	Funding Program	\$\$ Nationwide	\$\$ Tennessee
2001	WCRP	\$50 million	\$838,000
2002	SWG	\$65 million	\$997,000
2003	SWG	\$85 million	\$1.3 million
2004	SWG	\$70 million	\$1.07 million
2005	SWG	\$69 million	\$1.07 million*

*States have not been notified of exact funding allocations as yet.

Tennessee's CWCS is the result of the most comprehensive planning effort ever undertaken by the TWRA. This strategy identifies:

- criteria for evaluating species of greatest conservation need,
- a terrestrial habitat system that can be mapped to various spatial scales (i.e. statewide, eco-regionally, locally),
- an aquatic habitat classification system that can be mapped to various spatial scales (i.e. statewide, aquatic drainage, hydrologic unit (HUC),
- subterranean habitats based on known cave locations and surrounding terrestrial habitat units,
- a stress/source-of-stress hierarchy to identify issues/problems, and
- a hierarchy of terrestrial, aquatic, and subterranean conservation actions.

This new federal funding has enabled the TWRA to expand the Nongame and Endangered Species Program substantially. Projects have included habitat acquisition, habitat restoration, habitat management, species inventories, and species re-introductions. Additionally, with the development of the CWCS, the NGESP now has a GIS based planning tool that allows nongame planners and biologists to analyze species occurrence data and model habitat.

Future Use

Tennessee is appreciative of new federal funding through the State Wildlife Grants Program. However, with the development of our CWCS, it is exceedingly apparent that much work remains to be done. In order to address the issues, problems and opportunities identified in the CWCS and carried forward in this plan, an increase in permanent funding is needed.

The Conservation and Re-investment Act is still a viable option for funding. Likewise, passage of the American Outdoors Act (Senate Bill 964) would provide \$350,000,000 nationwide for wildlife conservation and restoration. Passage of either bill would result in an estimated \$6,000,000 of new federal funds for Tennessee. Both bills do require a nonfederal match of 25%.

The federal/state partnership is the basis of funding for the American model of wildlife management. This funding basis being, federal funds must be matched with nonfederal funds on a 75% / 25% ratio, respectively. In order for the TWRA to fully utilize new federal funding, new nonfederal funding must also be identified and secured. In order for

the Nongame and Endangered Species Program to address issues, problems and opportunities identified below, securing nonfederal matching funds is a challenge that must be met.

Habitat loss and degradation will continue to be a substantial problem in the future. Tennessee's population growth is expected to increase 1.5 million people over the next 20 years (Tennessee Advisory Commission on Intergovernmental Relations and The University of Tennessee Center for Business and Economic Research, 2003). Much of the population increase is expected around Nashville, in Middle Tennessee, Knoxville, in East Tennessee, and the Cumberland Plateau region, in between.

The south is expected to lose 12 million acres of forest from 1992-2020 (Southern Forest Resource Assessment, 2002). Forested areas surrounding Nashville are specifically identified for loss due to urbanization.

Along with forest loss, fragmentation of the remaining forests occurs when land use changes result in forest patches. Forest fragmentation can impact nongame wildlife in a number of ways (i.e. incompatible habitat size, increased edge, invasion of exotics, lack of habitat connectivity).

Water quality of the state's streams, rivers and reservoirs will continue to be an issue. Over 9,500 miles of streams in Tennessee are impaired or threatened (TDEC, 2004). Physical impairments to streams include siltation, habitat alteration and flow alteration, while chemical impairments include excessive nutrient loading, low dissolved oxygen, pH, metals and organic pollutants. Additionally, over 54,000 acres of wetlands have been identified as impaired by pollution and/or loss of hydrologic function.

Wildlife watching and the public's interest in nongame wildlife will continue to be a significant recreational pass-time for Tennesseans. Tennessee has over 1 million residents who participate in birding activities with an additional 340,000 non-resident visitors watching birds in Tennessee (La Rouche, 2005).

METHODS

As a requirement for WCRP and SWG funding, all 50 states and 6 territories were required to develop a Comprehensive Wildlife Conservation Strategy. Eight elements pertaining to species of conservation need, habitats, problems and conservation actions, and monitoring were required components of the strategy (Appendix B). This comprehensive wildlife strategy was unlike any the TWRA had ever developed in the past. The Agency dedicated full-time employees to strategy development, in addition to partnering directly with the Tennessee Chapter of The Nature Conservancy. Additionally, a steering committee of federal and state agencies and nongovernmental organizations was seated to offer guidance.

Synthesis of the information contained in the CWCS is the basis for the goals, objectives, problems and strategies identified below. Because the CWCS addressed NOM, T and E species (state and federal), and because problems identified for nongame are essentially

duplicates of the problems identified for rare species, problems and strategies have been considered for both below.

NONGAME GOAL

To conserve, manage, enhance and protect Tennessee's nongame wildlife populations and diversity within their associated habitats and to provide for public use (including education and recreation), understanding and enjoyment of these resources.

NONGAME OBJECTIVES

1. To conserve and manage nongame populations to limit new listings on the need of management list while enhancing 5 nongame populations, moving them toward down listing from the need of management list.
2. To conserve, manage, restore and enhance 2500 acres of habitat for the benefit of nongame and wildlife in need of management.
3. In order to restore Tennessee's native fauna, maintain current re-introductions and population augmentations as necessary and/or feasible and develop 3 additional re-introduction/augmentation projects of extirpated species into suitable habitat within their historic range.
4. Expand current and develop new public educational and recreational opportunities in order to increase participation in wildlife watching activities from 6.5 million man-days to 7 million man-days.

ENDANGERED SPECIES GOAL

To protect, manage and, where possible, augment, enhance and restore populations of E and T species of wildlife and their associated habitats.

ENDANGERED SPECIES OBJECTIVE

To protect, conserve and manage threatened and endangered species populations to prevent further species decline, up listing and extirpations while working to restore 5 species moving them toward down listing.

PROBLEMS, OPPORTUNITIES, ISSUES AND STRATEGIES

- I. Problem** - Certain types of human activities negatively impact nongame, In Need of Management (NOM), threatened (T) and endangered (E) species habitats (terrestrial, aquatic and subterranean).

Strategies:

1. Identify areas of importance to nongame, NOM, T and E species and singularly or in partnership with other agencies or organizations, acquire

habitat through fees simple acquisition, conservation easement or donation.

2. Restore native forests, wetlands, grasslands, stream channels and riparian zones to provide quality habitat areas to nongame, NOM, T and E species.
3. Establish/expand wildlife management areas, refuges and sanctuaries and develop ecosystem based management plans to protect nongame, NOM, T and E species populations and habitats.
4. Expand and utilize government-funded incentive programs for landowners to maintain ecosystem services, restore /manage forests and improve/protect water quality.
5. Establish in-stream flow requirements for Nongame, NOM, E and T species.
6. Develop strategic alliances among state agencies (TDEC, TDOT, TDF and others), federal agencies, (USFWS, USFS, EPA, TVA, and others), NGOs, local government, professional trade associations, recreational organizations, & others to focus on regional landscape and water issues.
7. Participate in the environmental review process and assist in the evaluation and development of standards.
8. Participate in the review of county urban growth management plans and encourage local governments to offer incentives for conservation based construction, development and land/water conservation.
9. Incorporate information about nongame, NOM, T and E species management & habitats into forestry training programs and develop more stringent forestry Best Management Practices based on differences in regional landforms.
10. Form partnerships with other states/countries to manage the habitats of wide ranging species.

II. Opportunity – Non-federal are often limited for use in nongame, NOM, T and E species management activities. Also, matching dollars are often required to fully utilize monies from federal grants and other grant programs. Therefore, additional sources of revenue must be secured.

Strategies

1. Increase efforts to secure needed funding through other avenues such as private grant programs, private donations, legislation other non-federal funding mechanisms.
2. Incorporate/expand network of volunteers to conduct inventories and monitoring of nongame, endangered species and their habitats. Utilize this volunteer effort as matching "in-kind" services.

III. Problem - Lack of information concerning the status and distribution of nongame, NOM, T and E species populations, their ecological limiting factors, and subsequent management implications.

Strategies:

1. Continue to modify, update and expand, as needed, Tennessee's Comprehensive Wildlife Conservation Strategy and associated planning tools.
2. Conduct species inventories, monitoring, assessments, as well as habitat evaluations to determine community integrity, relative abundance of species, population densities and ecological requirements of nongame, NOM, T and E species.
3. Conduct needed research on species life history, ecological needs, population viability or other identified problems or issues facing nongame, NOM, T and E species
4. Use GIS and other systems and databases for identifying, measuring, monitoring, and mapping key habitats, species distribution, and problems, as well as developing management strategies.
5. Maintain current databases and develop a new central database to reconcile & maintain information for nongame species, NOM, T, E and exotic species.
6. Evaluate standards for review of state & federally listed species.
7. Develop state standards for in-stream flows for nongame, NOM, T and E species.
8. Monitor contaminant loads in key species in order to develop baseline data, measure load trends and identify problems.

IV. Problem - Absence or scarcity of nongame, NOM, T, E and extirpated species in suitable habitat.

Strategies:

1. Re-introduce historic/extirpated populations or augment existing populations.
2. Conduct the needed research on species life history, ecological needs, population viability or other identified problems or issues facing species.
3. Establish propagation facilities to increase populations of species and investigate ex-situ methods of propagation as needed.
4. Form partnerships with other states/countries to cooperatively manage species and habitats.
5. Use GIS and other systems and databases for identifying, measuring, monitoring, and mapping key habitats, species distribution, and problems, as well as developing management strategies.
6. Remove or modify physical barriers that disrupt habitat/population connectivity for species or populations.

V. Problem - Exotic plant and animals may pose a threat to indigenous species.

Strategies:

1. Organize an exotic species task force to coordinate and manage information on exotic species. Propose/support regulations to restrict import of injurious/invasive exotic species to TN.
2. Develop and conduct rapid assessments of priority habitats for the presence of invasive exotics.
3. Establish a central GIS database to track occurrences of severe category invasive exotic species and maintain information on control measures and current management efforts statewide.
4. Implement integrated pest management practices to control or prevent invasive exotic species & pathogens from establishing populations.
5. Develop a multi-media public outreach campaign to promote awareness of invasive exotic species and encourage the use of native plants in horticulture, erosion control and wildlife plantings.

VI. Opportunity - Lack of public understanding concerning the status, values, threats and needs of nongame, NOM, T and E wildlife must be addressed in order to develop and foster program support and assistance in management activities.

Strategies:

1. Promote public awareness of issues affecting nongame, NOM, T and E species through the development of multi media outreach campaign (web page, magazine articles, brochures, videos, school curricula, presentations, public appearances, displays, Tennessee Wildside TV segments, information guides and other outlets).
2. Promote existing and create additional outdoor education (wildscaping, schoolyard habitats), recreation (Wildlife Observation Areas, nature trails and greenways, and photography) and volunteer opportunities (Tennessee Amphibian Monitoring Program, student internships).
3. Promote habitat conservation programs (LIP, CRP, WRP, EQIP, WHiP, GRP and others) and provide the public with technical assistance in utilizing and implementing these programs.

VII. Problem - Some nongame, NOM, T and E species and habitats are being negatively impacted by illegal activities and exploitation.

Strategies:

1. Enforce current laws and regulations affecting nongame and endangered species; support legislation to strengthen these laws and increase penalties for illegal taking and trade in wildlife and the alteration/destruction of habitat.
2. Provide nongame funding to TWRA law enforcement to assist with compliance of state laws, proclamations and rules pertaining to nongame species issues.

3. Increase training to TWRA law enforcement officers to address illegal activities and exploitation issues (identification of native species likely to be sought for illegal trade, state and federal law review, handling of dangerous species and other pertinent subjects).
4. Identify and protect populations that may be vulnerable to over-collection and disturbance.
5. Participate in the environmental review process to minimize negative wildlife impacts and mitigate losses where unavoidable.
6. Evaluate standards for review of state listed species and develop standardized criteria for listing of NOM, T and E species.
7. Assist other state and federal law enforcement in compliance of permits (collection, falconry, importation, captive wildlife, wildlife rehabilitation).

VIII. Opportunity – Rehabilitators provide a valuable service to the public and to species management.

Strategies:

1. Encourage established rehabilitation centers to provide the necessary training to parties interested in wildlife rehabilitation.
2. Provide grants to rehabilitators handling cases involving species of management concern (White-tailed deer, Bald Eagle, etc).

IX. Problem – Wildlife held in captivity can pose a threat to public safety by acting as a disease vector and by the maintaining of dangerous species (Class I Wildlife) in an unsafe manner.

Strategies:

1. Provide increased effort and assistance to law enforcement areas in terms of handling nongame wildlife, as well as in investigating illegal activities with nongame wildlife and captive wildlife.
2. Prohibit the use of known rabies vectors from use in educational programs where contact with the public is possible. Prohibit the rehabilitation of known rabies vector species.
3. Provide 4.5 hours of training in law review including the use of scenarios involving captive wildlife to new officers.

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APPENDIX A

T. C. A. 70-8-103.

Endangered species" means:

(A) Any species or subspecies of wildlife whose prospect of survival or recruitment within the state is in jeopardy or are likely within the foreseeable future to become so due to any of the following factors:

- (i) The destruction, drastic modification, or severe curtailment of its habitat;
- (ii) Its overutilization for scientific, commercial or sporting purposes;
- (iii) The effect on it of disease, pollution, or predation;
- (iv) Other natural or man-made factors affecting its prospects of survival or recruitment within the state; or
- (v) Any combination of the foregoing factors; or

(B) Any species or subspecies of fish or wildlife appearing on the United States' List of Endangered Native Fish and Wildlife as it appears on April 5, 1974 (Part 17 of Title 50, Code of Federal Regulations, Appendix D), as well as any species or subspecies of fish and wildlife appearing on the United States' List of Endangered Foreign Fish and Wildlife (Part 17 of Title 50 of the Code of Federal Regulations, Appendix A), as such list may be modified hereafter;

"Threatened" means any species or subspecies of wildlife that is likely to become an endangered species within the foreseeable future;

"Wildlife in need of management" means any species or subspecies of wildlife that needs specific management to prevent it from becoming a threatened species within the state in the foreseeable future.

APPENDIX B

(taken from Federal Assistance Guidance of May 9, 2002.)

Q6. What must be contained within the Comprehensive Wildlife Conservation Plans, and is there a universal format to ease interstate collaboration and utility?

A. The Comprehensive Wildlife Conservation Plans (and Wildlife Conservation

Strategy) must include the following items:

- (i) information on the distribution and abundance of species of wildlife (defined in Q9), including low and declining populations as the State fish and wildlife agency deems appropriate, that are indicative of the diversity and health of the State's wildlife;
- (ii) descriptions of locations and relative condition of key habitats and community types essential to conservation of species identified in (i);
- (iii) descriptions of problems which may adversely affect species identified in (i) or their habitats, and priority research and survey efforts needed to identify factors which may assist in restoration and improved conservation of these species and habitats;
- (iv) descriptions of conservation actions proposed to conserve the identified species and habitats and priorities for implementing such actions;
- (v) proposed plans for monitoring species identified in (i) and their habitats, for monitoring the effectiveness of the conservation actions proposed in (iv), and for adapting these conservation actions to respond appropriately to new information or changing conditions;
- (vi) descriptions of procedures to review the State Comprehensive Wildlife Conservation Plan at intervals not to exceed ten years; and
- (vii) plans for coordinating the development, implementation, review, and revision of the State comprehensive wildlife conservation plan with Federal, State, and local agencies and Indian tribes that manage significant land and water areas within the State or administer programs that significantly affect the conservation of identified species and habitats.

No universal format for these plans exists at this time. FA will work with the States and other stakeholders, however, to develop suggested guidance regarding the format of plans.

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CURRENT AND PROJECTED STATUS

Tennessee reservoirs provide a variety and abundance of fishing opportunities across the state. This program provides fisheries management for 32 man-made impoundments, representing 500,618 surface acres and one natural lake (Reelfoot Lake), representing 10,427 acres (Table 1). The reservoirs range in size from 541 acres to 108,217 acres within the state boundaries and measure an additional 202,380 acres outside the state (Figure 1).

Large Tennessee reservoirs consist of mainstream impoundments, tributary impoundments, and Reelfoot Lake, formed by an earthquake in the early 19th century. All reservoirs are located within the Cumberland or Tennessee River drainages. Large reservoir and lake resources range from shallow, hypereutrophic Reelfoot Lake in northwestern Tennessee to deep, clear, and highly oligotrophic Watauga Reservoir in the northeastern corner of the state.

Warmwater reservoirs provide the most popular public fishing areas with more than 458,383 adult Tennesseans (age 16 or over) fishing the state's reservoirs during 2004 (Stephens and Fly 2005). An estimated 50.8 % of the state's angler population reported fishing in reservoirs between March 1 and August 31, 2003, and overall reservoir sport fishing expenditures were estimated at over \$285 million. The statewide reservoir creel survey indicated that the black bass species continued to be the most sought after fishery, comprising 34 % of the targeted effort in 2004 (Malvestuto and Black 2005).

All reservoirs provide free fishing to the public and boat and bank access has been provided by several agencies. Major, self-sustaining fisheries include black bass (largemouth, smallmouth, and spotted bass), crappie (white and black), catfish (blue, channel, and flathead), sunfish (primarily bluegill and redear), sauger, walleye, and white bass. Stocked fisheries include trout (rainbow and lake), muskellunge, striped bass, and Cherokee bass (hybrid striped bass). Supplemental stockings of blacknose black crappie, Florida strain largemouth bass, walleye, and sauger have been used to enhance fisheries or provide unique fishing experiences in some reservoirs.

Fish communities within Tennessee reservoirs vary greatly in quality and abundance. Watershed characteristics influence the character of both tributary and main river impoundments. The biological capacity at each reservoir and public demand are the primary factors driving which species will be managed in a particular fish community. Sport fishing opportunities are limited by available habitat, predator-prey balance, and productivity of each system.

Most of the 1990's have been characterized by erratic weather patterns that have affected fish populations. Rainfall has influenced habitat factors such as water quality, flows, water levels, and aquatic vegetation which, in turn, have influenced spawning success and recruitment of several sportfish species. Many fish populations such as crappie and sauger have cycled in abundance since the droughts of the 1980's. Productivity measured in standing crop (pounds per acre) or density (catch per unit effort) varies across the state,

within each reservoir, and from year to year. Nutrient inflow from watersheds is the primary limitation of reservoir productivity. Water pollution, water level fluctuation, and habitat degradation also negatively impact reservoir fish populations and must be addressed by this plan.

PAST, PRESENT, AND FUTURE USE

Past Use

Reservoir acreage in Tennessee grew rapidly from the 1930's through the 1970's due to the dam construction by the U.S. Army Corps of Engineers and the Tennessee Valley Authority. Future expansion in reservoir acreage is expected to be minimal.

Between 1977 and 1987, anglers expended an average of 5.5 million hours (15 hours/acre) fishing on reservoirs in which creel surveys were conducted. Creel survey data collected during the 1994-98 strategic plan period indicated considerable variation in annual fishing effort (range 8.3 - 15.5 million hours). The average value for annual fishing effort over this period was 10.5 million hours (21 hours/acre), representing a 28% increase in fishing pressure from the past decade. Although some of the variability in effort was attributable to which reservoirs were surveyed and improvements in survey methodology, this period can be considered the peak of fishing effort for Tennessee reservoirs. Black bass and crappie continued as the most sought after species followed by catfish and striped bass or Cherokee bass (hybrid striped bass).

Present Use

Most of the 1990s were characterized by erratic weather patterns that affected sport fisheries in Tennessee. More recent creel survey data show that reservoir fishing effort flattened late in the 1990s, but has remained consistent from 1999 through 2004. In general, fishing effort appears to have decreased slightly from the previous plan period with annual values determined from varying between 6.7 million to 7.5 million angler-hours (mean = 7.1 million hours). The high value of 7.5 million angler hours was recorded for 1999, suggesting a slight downward trend in fishing effort since that year. The number of angler trips documented through creel surveys also changed little during the plan period, varying only from 1.1 to 1.7 million (mean value = 1.3 million trips). The species most targeted by anglers remained the same as the previous plan period: black basses followed by crappie, catfish, and striped bass/Cherokee bass.

Telephone surveys during the plan period indicate that the number of Tennessee anglers fishing large reservoirs declined approximately 8% from 2000 to 2004 (Figure 3)(Stephens and Fly 2005). The surveys indicated that the proportion of Tennessee anglers fishing small impoundments (<500 acres) now exceeds the proportion fishing at reservoirs. Despite the decrease in reservoir fishing participation by state residents over the last strategic plan period, overall angler numbers and fishing license sales (resident and non-resident) have remained stable or increased in Tennessee (U.S. Dept. of the Interior 2001; TWRA, unpublished data). This suggests that while the number of

reservoir anglers may have dropped slightly, their level of avidity has increased to maintain fishing effort at much the same level in recent years (Figures 2 and 3).

Considerable effort has been aimed at providing optimal fishing experiences through implementation of new harvest restrictions over the past six years. TWRA fishery biologists have been diligent in making daily creel limits and size limits as uniform as possible. Length limits have been tailored for high-harvest fisheries (e.g., crappie and walleye) and to provide a higher level of protection for fisheries that are largely catch and release (e.g., largemouth and smallmouth basses). Stephens and Fly (2005) found that angler satisfaction with TWRA's reservoir fisheries management has remained high (> 80%) despite a flurry of sometimes-controversial harvest restrictions passed during the last several years.

Future Use

Statewide reservoir fishing effort is expected to remain stable during the next 15 years. The "boom" years of reservoir fishing have passed and no new reservoir construction is likely. Minor variations in numbers of hours fished are expected, mostly in response to natural changes in sport fish population abundances. TWRA's efforts to market sport fishing to new and non-traditional anglers will seek to reverse the demographic trend of older and fewer Tennessee anglers.

User conflicts will continue to be a concern during the next 15 years as the overall use on reservoirs continues to increase. Conflicts between water providers, residential developers, recreational boaters, and anglers can be expected as competition for access and space on Tennessee reservoirs continues. Conflict between angler groups may increase as specialization within the sport expands. TWRA must strive to resolve reservoir resource conflicts in ways that benefit stakeholders and sport fisheries.

Further declines in reservoir sportfish stocks may also be expected as reservoirs continue to age and habitat is lost. Trophic state of reservoirs may also decline in response to stricter nutrient standards promulgated by state regulatory agencies, resulting in reductions in fishery carrying capacity, growth rates, and forage fish densities. TWRA fishery staff will be challenged to provide input on the effects of nutrient control on reservoir fish communities.

Habitat enhancement projects and fish attractor projects that strive to enhance fish survival and recruitment as well as bring anglers and fish together will become increasingly important components of TWRA's reservoir management program. Demands for stocked fish from TWRA hatcheries can be expected to increase as natural stock recruitment decreases from habitat loss and interactions with exotic species.

GOAL

Program Goal: Provide for diverse reservoir angling experiences by managing for multiple species and maximizing fishing quality within ecosystem limits in ways that are acceptable to stakeholders.

OBJECTIVES

1. Elevate fishing participation to a minimum 460,000 reservoir anglers; maintain an overall catch rate for sport fish at a minimum of 1.00 fish per hour; and to maintain a minimum value of 75% anglers satisfied with TWRA's reservoir fisheries program.
2. Enhance the impact of TWRA's reservoir stocking program by expanding production by 25% and rearing pond acreage by 40%.
3. Undertake a minimum of 100 reservoir fish habitat enhancement or fish attractor projects per year. Assess the effect of 4 habitat improvement methods during the plan period.
4. Build a minimum of 25 new bank fishing access points (e.g. piers) during the plan period.

OPPORTUNITIES, PROBLEMS, ISSUES, AND STRATEGIES

- I. Issue** – Demand for stocked fish continues to increase and exceeds production capacity in TWRA's warmwater hatchery system.

Strategies

1. Increase output of stockable fingerlings by 25% during the plan period.
2. Monitor genetic diversity in brood stock to ensure maximum survival and performance of stocked progeny.
3. Monitor fish disease in hatchery stocks to prevent high mortality at all life stages.
4. Conduct a minimum of one stocking success evaluation for two different species during the plan period.

- II. Issue** - Activities within a watershed affect the amount of critical fish habitat.

Strategies

1. Work with watershed partners to conduct or fund a minimum of one comprehensive study to identify which habitat enhancement methods provide the most benefit to reservoir sport fish populations and anglers.
2. Conduct a minimum of 500 site-specific activities per year to provide fish cover, stabilize shorelines, or promote the growth of aquatic vegetation.
3. Develop methods used to routinely measure “success” of habitat enhancement activities on a site-by-site basis.
4. Monitor summer temperature and dissolved oxygen on all reservoirs with a history of water quality problems.
5. Provide input to reservoir operators (e.g., TVA and Corps) on how altered flows, water level management and shoreline encroachment may affect fisheries habitat.

III. Issue – Fishery assessment and monitoring must match management needs.**Strategies**

1. Monitor and assess sport fish population parameters at a minimum of 25 reservoirs per year.
2. Monitor fishing pressure through creel surveys at a minimum of 15 reservoirs per year.
3. Fund a minimum of 2 studies on recruitment, angler exploitation, or mortality and their effects on sport fish populations during the plan period.
4. The Law Enforcement Division should develop a system to monitor compliance with current fish regulations by species and reservoir during the plan period.
5. Monitor the introduction, migration, and abundance of aquatic nuisance species (ANS) at a minimum of 25 reservoirs per year.
6. Increase tournament reporting for TWRA’s B.I.T.E. program by 50% during the plan period.
7. Conduct a minimum of two statewide surveys on economic impact of reservoir sport fishing during the plan period.
8. Collect fish for contaminant analyses when requested by the Environmental Services Division.
9. Monitor disease trends in reservoir fish populations when outbreaks occur.
10. Conduct a minimum of 10 genetics assessments on reservoir wild fish populations to monitor genetic diversity or evaluate genetic manipulation through stocking (e.g., Florida bass stocking program) during the plan period.

IV. Issue – Marketing and communication to existing and prospective anglers is vital to grow the sport and maintain a funding base for reservoir fisheries management.**Strategies**

1. The I&E Division will work with TWRA fisheries staff to provide and implement management strategies for retaining current reservoir anglers during the strategic plan period.
2. The I&E Division will work with fisheries staff to develop and implement a plan for recruiting new anglers through direct marketing to immigrants, urban dwellers, and traditionally non-fishing groups during the plan period.
3. Retain and recruit new anglers by providing a minimum of one new incentive or angler recognition directed at socioeconomic groups that are not traditional reservoir anglers (e.g., women, immigrants, urban dwellers).
4. The I&E Division will work with fisheries staff to develop a working plan for educating anglers about reservoir fishing opportunities, fishing regulations, and licensing. All available media should be used including publications, videos, and web pages.
5. TWRA will include other governmental agencies and non-governmental organizations (NGOs) in its communication efforts when appropriate and partner with these groups on funding when possible.

V. Issue – Fishing access for anglers and boaters is inadequate on many Tennessee reservoirs.

Strategies

1. Build, maintain, or improve a minimum of 25 ADA-compliant bank access areas at reservoirs or tailwaters during the plan period.
2. Construct or improve a minimum of 10 ADA-compliant boating access or parking areas at reservoirs during the plan period. These areas must be accessible throughout the year.
3. Buy or acquire easements at 20 sites that will be used for angler access or shoreline buffer areas during the plan period.
4. Work with TWRA marketing coordinator to develop a method for determining site-specific use by anglers by the end of the plan period.
5. Develop partnerships and cooperative agreements to reduce agency costs for new fishing access.
6. Provide input to TVA and Corps on their policies for public encroachment onto federally-owned, riparian land.
7. Provide clear policies for maintenance and access ownership in contracts and make sure both contracting parties and public are aware if and when access fees can be charged.

VI. Issue – Conflicts over reservoir use and resource allocation are expected to increase over time.

Strategies

1. Identify potential conflicts between reservoir user groups and work with regulators and conflicting parties to resolve disagreements when they occur.

2. Conduct a minimum of 10 public meetings or angler focus groups to foster understanding of fishery resource demands and angler specialization.
3. Work to resolve long-standing conflicts between commercial and recreational anglers.

METHODS

Performance measures used in objectives and strategies were obtained from trends in the annual TWRA telephone survey conducted by the University of Tennessee Human Dimensions Research Lab. Other performance measures were derived from reservoir creel surveys or data collected by various TWRA divisions. Dollar value for reservoir fishing was expanded from economic data provided by the Human Dimensions Research Lab. The fishing participation target value (Objective 1) was calculated to regain approximately half the losses in reservoir anglers incurred over the previous plan period.

The planning committee for the reservoir program consisted of members of several agencies. Tim Churchill (Chairman), Eric Ganus (Recorder), Pat Black, Tim Broadbent, Doug Markham, Mike Jolley, Doug Peterson, Mike Smith, and Todd St. John were all from TWRA. Tyler Baker from TVA's Chattanooga office and Dr. Phil Bettoli from the U.S. Geological Survey also participated. Two meetings were held at TWRA's main building in Nashville: one on March 23, 2005 and a second meeting on July 14, 2005.

DATA SOURCES

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Table 1. Surface Acres of Tennessee Reservoirs Greater Than 500 Acres. Reelfoot Lake is included.

	Acres in Tennessee	Total Acres	Data Source*
Barkley	18,300	57,420	3
Boone	4,520		1
Calderwood	541		1
Center Hill	18,220		2
Cheatham	7,450		2
Cherokee	30,300		1
Chickamauga	34,500		1
Chilhowee	1,750		1
Cordell Hull	11,960		2
Dale Hollow	23,200	27,700	3
Douglas	30,600		1
Ft. Loudoun	14,600		1
Ft. Patrick Henry	872		1
Great Falls	3,080		1
Guntersville	1,156	67,900	4
John Sevier	786		4
J. Percy Priest	14,200		2
Kentucky	108,217	160,300	4
Melton Hill	5,690		1
Nickajack	10,370		1
Normandy	3,048		4
Norris	34,200		1
Old Hickory	22,500		2
Parksville	1,890		1
Pickwick	6,159	43,100	4
Reelfoot L.	10,427		4
South Holston	6,336	7,580	4
Tellico	16,056		4
Tims Ford	10,600		1
Watauga	6,430		1
Watts Bar	39,000		1
Woods	3,660		4
Total	<hr/> 500,618		

- *1. TVA 1980
- *2. U.S. Army Corps of Engineers 1978
- *3. -----, H. Phillips, personal communication 1993
- *4. TWRA 2000

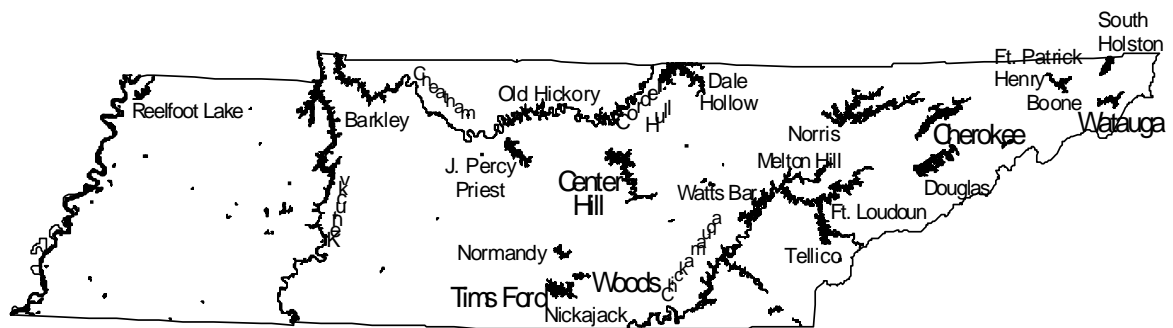


Figure 1. The major reservoirs of Tennessee (including Reelfoot Lake).

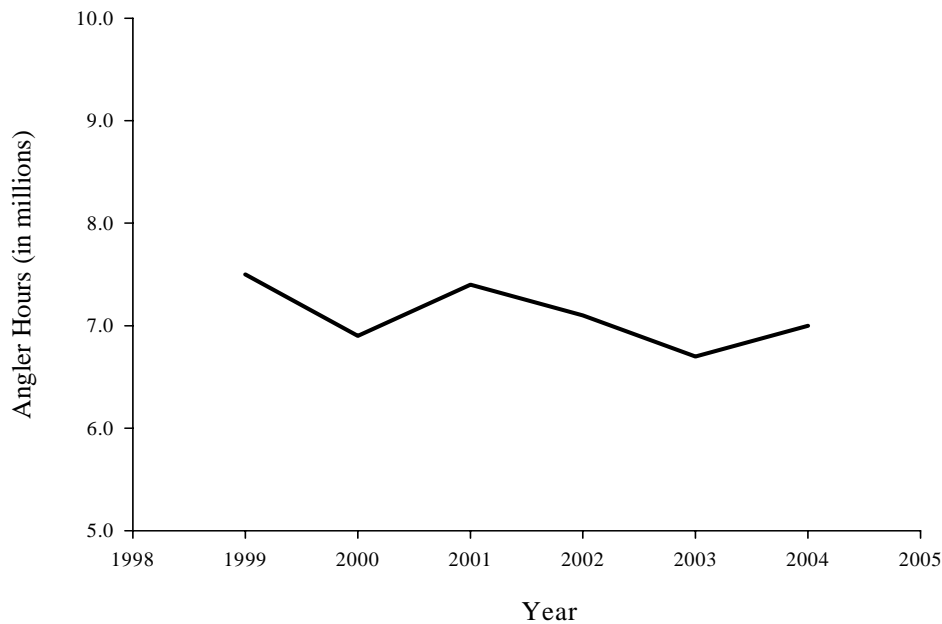


Figure 2. Reservoir fishing effort in angler hours derived from TWRA creel surveys 1999–2004.

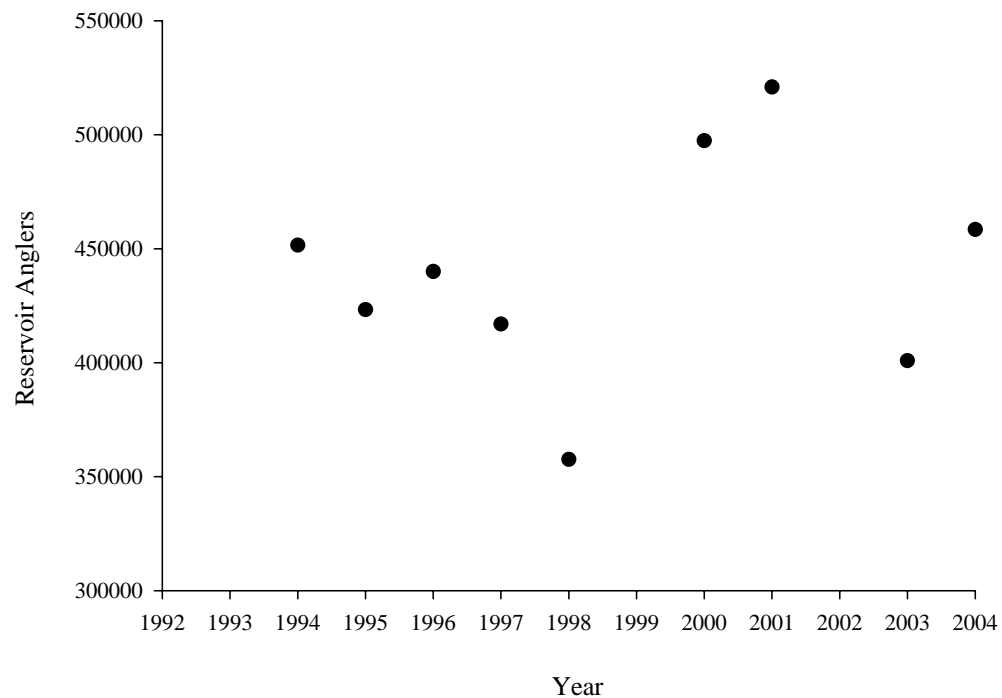


Figure 3. Reservoir fishing population 1994–2004 based on number of anglers fishing between March 1 and August 1. Each data point represents an individual telephone survey year.

CURRENT AND PROJECTED STATUS

There are three large river systems in Tennessee: the Mississippi, the Tennessee, and the Cumberland. The Mississippi River is the largest riverine ecosystem in North America and the third largest in the world. This dynamic, large flood plain river ecosystem flows along the 167 miles of Tennessee's western border. Over 45% of the Tennessee River's 886 miles flow through both eastern and western Tennessee and it is the largest tributary of the Ohio River. The Cumberland River is also a tributary of the Ohio River and a similar proportion of its 686 miles flow through the northern section of middle Tennessee. Much of the riverine habitat in the Tennessee and Cumberland rivers was converted to reservoirs with the construction of dams. Despite their impoundment, these two systems still boast valuable riverine sections in the upper ends of most reservoirs.

Tennessee's large rivers provide important recreational and commercial resources. These rivers and their floodplain lakes currently have sport fisheries for catfish, black bass, crappie, sauger, white bass, striped bass, and bream. Commercial fisheries exist for catfish, paddlefish, shovelnose sturgeon, buffalo, and other riverine fishes. Other public uses of rivers include water supply, aggregate dredging, waste dilution, navigation, and power generation.

PAST, PRESENT, AND FUTURE USE

Until the 1930's, nearly all the public fisheries in Tennessee were in rivers and streams. As reservoirs were impounded, many anglers shifted their participation to reservoir fisheries. Although many of the traditional river fisheries were still important to both recreational anglers and commercial fishers, reservoir management demanded most of TWRA's attention. Many large river issues (i.e., habitat degradation, sampling of large river species) on the Tennessee and Cumberland rivers were not addressed by the reservoir program and TWRA's management of the Mississippi River fisheries was minimal. However, the current outlook for large river management is promising. In this decade, organizations such as the Lower Mississippi Resource Conservation Committee and the Cumberland River Compact were formed to address large river issues that are limiting the use of these valuable resources.

Current statistics describing angler use of Tennessee's large river fisheries are not available. Reservoir creel surveys on the Tennessee and Cumberland rivers are not designed to effectively target large river anglers and there has never been a creel survey on the Mississippi River. Obtaining these statistics as well as basic angler demographic information will be one of TWRA's primary objectives during this plan period because this information is necessary to properly manage Tennessee's large river fisheries.

During the next 15 years, public use of Tennessee's large river resources will increase slightly. In general TWRA license sales data suggest that the number of anglers has been steadily rising, although the proportion of the population that fishes has been declining. With proper management an increase in the number of large river anglers might be

expected as the population of Tennessee increases; however, observations from national population demographics reveal that fewer younger individuals are getting involved in fishing (Responsive Management 1995). Consequently, as existing anglers leave the sport, fewer anglers will replace them. This situation will require TWRA to increase efforts to attract new users and increase public awareness about large river resources because without concerned users, Tennessee's large river fisheries are susceptible to further degradation and neglect.

There are several environmental and social issues that are likely affecting the use of Tennessee's large rivers by recreational anglers and commercial fishers. Pollution from nonpoint and point sources continues to threaten Tennessee's large rivers. The Tennessee Department of Environment and Conservation (TDEC) and TWRA are currently struggling to protect Tennessee's rivers from pollution and alterations. However, residential and industrial encroachments are increasing and without additional funding, it is doubtful that these agencies will be able to control large river degradation. Population growth and subsequent development will also create more demand for water. Each year additional demands from municipalities and the private sector result in increased use of surface water and ground water.

Most of the land in the watersheds for Tennessee's large rivers is privately owned and used for agriculture. The impact of farming on riparian zones is staggering, as is the potential for improvements. Thousands of miles of riparian zones have been impacted by agricultural development, and thousands more have riparian buffers which need to be expanded to accommodate shifting channels in the future. Loss of riparian zones will increase water temperature, increase siltation, and ultimately limit fish habitat in large rivers. Recent programs like Wildlife Habitat Incentive Program (WHIP) and Environmental Quality Incentives Program (EQIP) are designed to slow this process but their success is not likely at the current participation rate.

Another trend which is likely limiting the use of large rivers is the lack of access or the poor condition of current access areas. Tennessee's large rivers possess a wealth of recreational potential but without access these recreational opportunities are exploited by few. Each year, more landowners along large rivers are denying access to anglers. Because practically all large river fisheries are surrounded by privately-owned land, this trend will continue to jeopardize TWRA's ability to provide recreational opportunities in large rivers. Providing, improving, and maintaining safe, family-orientated boat ramps and bank fishing facilities should be a major focus of future TWRA management efforts.

Increased use of Tennessee's large river fisheries will lead to an increased demand for the management of those fisheries. These fisheries should be sampled periodically to collect the information that is necessary to manage them properly. Reservoirs on the Tennessee and Cumberland rivers are sampled extensively by TWRA's reservoirs crews; however many large river fish species are not adequately sampled by traditional reservoir sampling gear. There has been very little sampling effort on the Mississippi River and the dynamic nature of this system will necessitate a unique sampling approach. Additionally, many riverine fish species are classified as "commercial." Although there are popular

recreational fisheries for many commercial species, these species have received very little management attention from TWRA. Modifications of existing sampling protocols and the development of a Mississippi River monitoring plan will be necessary to adequately sample and manage Tennessee's large river fisheries. Additionally many large river species are migratory and frequently cross state boundaries. Interstate management of these species is important from both the resource and user standpoints.

Tennessee anglers' methods and motivations have been continually changing and shifting from simple to complex. In the past, the importance of harvesting fish for subsistence was probably more important to the average river angler. While catching fish has always been an important component of fishing, other factors are typically important to today's anglers. Recent surveys have demonstrated that components of a fishing trip such as the outdoor experience or experience with friends or family are more important than simply just catching fish (Responsive Management 1995, Cleveland 1993). Also, many anglers have become so specialized that they may only target one species with a specific type of tackle or technique. How people fish, what they target, and where they fish often defines today's anglers. With such diversity among angler types, it is becoming increasingly important that TWRA understand how each angling group and how they will be affected by new management strategies.

The impoundment and channelization of Tennessee's large rivers has resulted in severe habitat degradation and rivers with very little habitat diversity. Improving and restoring habitat in Tennessee's large rivers will be necessary to improve these fisheries and attract more users. Identifying, funding, and completing large river habitat improvement projects will require a coordinated effort from all concerned agencies and organizations. TWRA's cooperation with other agencies and organizations to improve the habitat in Tennessee's large rivers will likely be the most important factor in the success of this plan.

GOAL:

Protect, restore, and enhance the quality and diversity of Tennessee's large river fisheries through cooperative efforts to enhance the habitat, biological communities, water quality and quantity, access, fishing experiences, and public awareness in these fisheries

OBJECTIVES:

Identify the current number of large river users by 2007 and increase the level of participation by 10% before 2012. Measure angler satisfaction by 2007 and identify methods to provide at least 75% satisfaction.

Identify and prioritize large river habitat improvement projects by 2007 and begin implementing 5 projects by 2009.

Develop methods to measure large river fish diversity in each habitat type by 2007.
Maintain or increase diversity of large river species and identify methods to enhance sport and commercial fish populations by 2012.

ISSUES, AND STRATEGIES:

- I. Issue** – Methods to sample large river fish communities and habitat have only recently begun to emerge in Tennessee. In order to fully understand the dynamics of these resources, standardized protocols must be developed to ensure consistent and valid assessments.

Strategies

1. Coordinate and modify current sampling efforts (TWRA, TVA, and COE) to better sample large river fish species and habitats. Identify weaknesses in current sampling schemes and try to improve techniques when possible.
2. Cooperate with other agencies and organizations to identify potential habitat improvement projects and create a prioritized list of these projects by 2007.
3. Research and develop categorical methods of identifying and assessing habitat features and investigate modifications of current Index of Biological Integrity techniques to Tennessee's large rivers during this plan period.
4. Conduct or fund at least one comprehensive study to identify important habitats for species of concern (i.e., sport, commercial, T&E).
5. Establish a sampling crew that is specifically assigned to the Mississippi River during this plan period.
6. Evaluate past habitat improvement projects to determine the most effective techniques.
7. Monitor effects of recreational and commercial harvest on large river species.
8. Cooperate with other agencies and organizations to establish a temperature, dissolved oxygen, and flow monitoring program in areas where this is a concern to insure compliance with state and federal water quality law.
9. Facilitate technology transfer among managing agencies when possible.
10. Assess influences of shoreline development.
11. Monitor disease trends when outbreaks occur.

- II. Issue** – Information regarding recreational use of large river fisheries is insufficient and this information is essential for management of these fisheries.

Strategies

1. Design and incorporate questions for UT's annual survey to estimate large river use and angler satisfaction each year.

2. Conduct a telephone or mail survey of Mississippi River anglers to collect basic demographic information and identify their concerns and desires by 2006.
3. Use information from telephone or mails surveys to design a creel survey for the Mississippi River by 2007 and implement this survey by 2008.
4. If necessary modify reservoir creel surveys to estimate the use and value of traditional and nontraditional fisheries below dams and in the riverine sections of reservoirs during this plan period.

III. Issue – Past and current use of private land impacts the quality of water and habitat in large rivers. Public health risk and the ecological consequences of degraded water quality and habitat in the aquatic environment directly affects all aspects of our large river fisheries.

Strategies

1. Partner with other agencies and organizations to educate developers, farmers, and municipalities about proper use of best management practices.
2. Continue participation in the interagency “Valley Wide Contaminants in Fish” project.
3. Promote the Tennessee Land Owner Incentive program and conservation easement opportunities along large river corridors and watersheds.
4. Insure public health by coordinating enforcement and monitoring activities with other agencies and organizations to reduce contaminant levels and insure compliance with state and federal water quality law.
5. Cooperate with local and state authorities to monitor point and non-point pollution sources.
6. Encourage and support agency partners in headwater protection programs.

IV. Issue – Funding for large river habitat improvement projects is limited and competitive among management agencies.

Strategies

1. Cooperate with other agencies and organizations to identify and acquire funding for habitat improvement projects and their evaluation by 2008. Partnering with other agencies and organizations is important because it allows TWRA to capitalize on cost-share opportunities.
2. Seek additional funding within the agency for large river habitat improvement by 2008.
3. Seek congressional funding such as WRDA 2000 to provide funding for the feasibility study (LMRRA) for habitat restoration on the Mississippi River.

V. Issue – Public access for large river users is inadequate or in need of improvement.

Strategies

1. Assess current access opportunities and develop a prioritized needs database that will guide future land acquisition on large rivers. Use angler surveys to identify potential high use areas that could be better utilized if access was improved.
2. Cooperate with other agencies and organizations to build, maintain, or improve ADA-compliant bank and boating access areas according to assessment needs from Strategy 1 and develop partnerships to preserve the aesthetics and safety of these areas. Locate new access areas in areas that will provide quality family oriented fishing opportunities.
3. Develop partnerships and cooperative agreements to identify, fund, and obtain suitable land along large rivers that will provide both bank fishing and boating opportunities.
4. Investigate opportunities to develop fishing easements with private landowners.

VI. Issue - Public awareness regarding large river resources and opportunities is limited because marketing and communication to existing and prospective large river anglers is inadequate.

Strategies

1. Develop and implement working plans for educating anglers about large river fishing opportunities (traditional and non-traditional), fishing regulations, boating, safety, productive fishing periods/techniques, and licensing by 2007. All available media should be used including publications, videos, and web pages.
2. Produce at least two magazine articles (i.e., Tennessee Wildlife) and one television episode (i.e., Tennessee Wildside, Midsouth Outdoors) that promote large river resources, stewardship, and recreation opportunities each year during the plan period.
3. Cooperate with other agencies and organizations to create and distribute maps of Mississippi River public access areas and/or fishing hot spots by 2007.
4. Provide support to current K-12 environmental education programs such as CENTS that emphasize personal responsibility and environmental ethics.
5. Communicate with other governmental agencies and non-governmental organizations when appropriate and partner with these groups to promote large river fisheries and their conservation (such as AARP, RC&Ds).
6. Develop and implement plans for recruiting new anglers through direct marketing to immigrants, urban dwellers, and traditionally non-fishing groups during the plan period. When possible, produce multilingual brochures and utilize local multilingual media sources educating the public about fishing regulations and educational strategies.
7. Increase involvement in local watershed councils and groups to promote and educate the public about large river resources.

VII. Issue – Many of Tennessee’s large river fish species require coordinated interstate and interagency management and enforcement efforts.

Strategies

1. Standardize regulations and management techniques with border states so interstate large river fisheries can be managed and enforced more efficiently.
2. Participate in interstate and interagency efforts to evaluate large river resources.
3. Attend regional and national meetings where large river fisheries management and enforcement are discussed.

VIII. Issue – Aquatic nuisance species (ANS) may be displacing native species in large river ecosystems.

Strategies

1. Monitor the introduction, migration, and abundance of invasive species.
2. Strengthen state laws designed to limit the spread of exotic species and inform the public about current regulations.
3. Cooperate with other agencies and organizations to investigate control measures for ANS.
4. Cooperate with other agencies and organizations to produce at least three brochures, magazine articles, or public service announcements to educate the public about the harmful and expensive effects of ANS.

IX. Issue – Large rivers host a multitude of user groups (which need to be defined) and conflicts among these groups will increase as the quantity and diversity of users increases.

Strategies

1. Develop methods to identify all users (i.e., recreational, commercial, municipal) of large river resources and determine the impacts each definable user group poses.
2. Determine the issues, which cause conflicts between user groups and document how these conflicts can be or were resolved. Use this information to identify methods to minimize or resolve future conflicts between user groups.
3. Conduct at least one public meeting or angler focus group each year (with special attention paid to giving ample notice) to foster understanding of fishery resource demands and user group specialization.

X. Issue – Current regulations and enforcement may not be adequate to ensure sustainability of sport and commercial fish species. Periodic review of fishing laws and regulations is necessary to properly manage Tennessee's large river fisheries.

Strategies

1. Annually evaluate sport and commercial harvest to determine if current regulations are sufficient to maintain sustainable populations and modify regulations as necessary to achieve program objectives.
2. Develop a system to monitor compliance with current fishing regulations during this plan period and implement techniques to improve compliance if necessary.

3. Recommend law and regulation changes to the Legislature and Tennessee Wildlife Resources Commission when necessary to attain program objectives.

METHODS

This strategic plan for the Large River Fisheries Program was developed by the Large River Fisheries Program's Strategic Planning Committee. Committee members were selected based on their knowledge of Tennessee's large rivers.

Chair: George Scholten (Wildlife Biologist, Fisheries Division - TWRA)

Committee: Tim Broadbent (Wildlife Manager, Region 1 – TWRA)
Bart Carter (Wildlife Manager, Region 4 - TWRA)
Margo Farnsworth (Cumberland River Compact)
Eric Ganus (Wildlife Manager, Fisheries Division - TWRA) Leaf Myczak (Tennessee Riverkeeper)
John Rumancik (Biologist - Memphis District Army Corps of Eng.)
Danny Scott (Assistant Manager, Region 2 - TWRA)
Edwin M. Scott (Aquatic Biologist, Heritage Program - TVA)
J. Michael Thron (Biologist - Memphis District Army Corps of Eng.)
Rob Todd (Assistant Chief of Environmental Services - TWRA)

The committee met from 9:00 to 3:30 on Monday, May 9, 2005 and Monday, August 22, 2005 in the main conference room in the Nashville office. "Brainstorming" techniques were utilized to develop and organize the goal, objectives, issues, and strategies. Priorities for issues and strategies were determined by averaging each committee member's individual rankings. Copies of the draft plan were available for public review November 17-December 19, 2005. Comments were solicited through statewide news releases in order to determine the public's opinions on the plan. Public comments were incorporated into the plan where appropriate.

DATA SOURCES

Cleveland, T. A. 1995. Angler survey of Tennessee sportsman license holders. M.S. Thesis. Tennessee Technological University, Cookeville. 64 p.

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CURRENT AND PROJECTED STATUS

Five species of tree squirrels are found in Tennessee. Two species are not hunted, the southern flying squirrel (*Glaucomys volans*) and the northern flying squirrel (*Glaucomys sabrinus*). These species are small and nocturnal, and thus are not often seen.

The red squirrel (*Tamiasciurus hudsonicus*) or “boomer” is the smallest of the hunted species. Its range is restricted to the higher elevations of the Appalachian mountains of east Tennessee. Due to its small size and restricted range, the red squirrel is not harvested in considerable numbers.

The fox squirrel (*Sciurus niger*) is the largest of Tennessee’s squirrels, weighing as much as 2 pounds or more. Two subspecies exist in Tennessee. The more abundant *S. n. rufiventor*, which is common in middle and west Tennessee and the Midwestern U.S., is characterized by the typical grayish back and sides with orange underside. In some areas of extreme west Tennessee, fox squirrels are the most abundant squirrel species. The “southeastern fox squirrel” (*S. n. niger*) is much less common and is found in scattered areas of east Tennessee, typically where mid-elevation mountain mixed hardwood-pine forests are periodically disturbed by fire. The southeastern fox squirrel typically has an agouti (a grizzled color of fur resulting from the barring of each hair in several dark and light bands) back and sides with orange undersides, but is distinctly marked with white and black ears and facial markings, some black on the back and feet, and is usually larger. The size, beautiful coloration and relative scarcity of this subspecies in the state relegate it somewhat to a trophy status among Tennessee squirrel hunters. In general, fox squirrels are adapted to more open and less wooded areas than gray squirrels.

The gray squirrel (*S. carolinensis*) is by far the most abundant squirrel in Tennessee, and is found statewide. Gray squirrels average about 1 pound. Even small woodlots and narrow fencerows often harbor a population of gray squirrels. As Tennessee’s hardwood forest resource has remained relatively stable over the years, squirrels are one of Tennessee’s most abundant small game species.

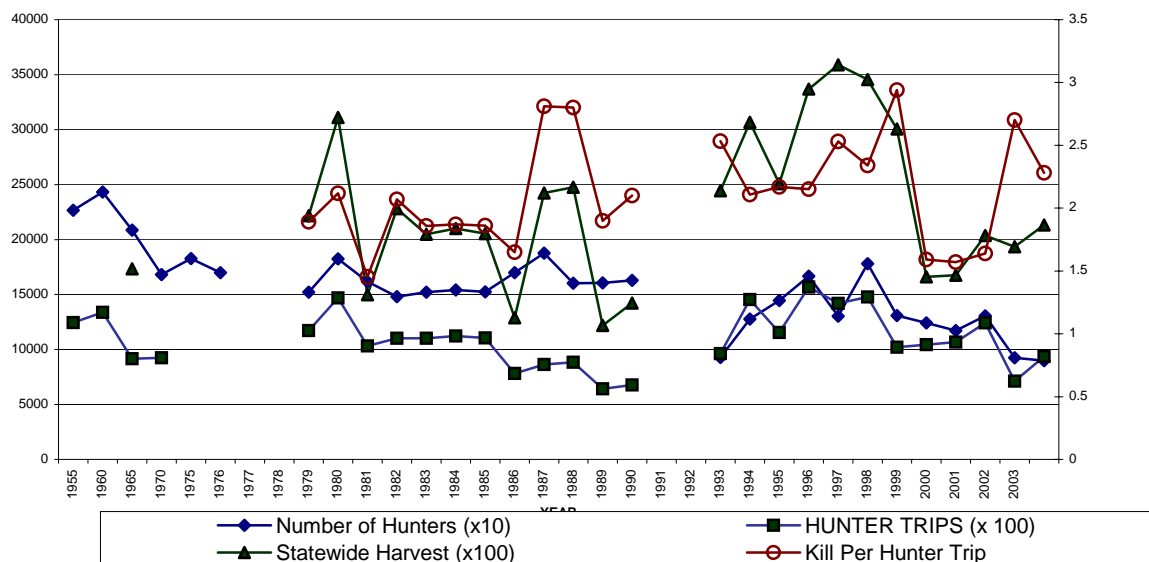
Squirrel populations are highly dependent upon hard mast (nuts produced by oaks, hickories, walnuts, beech, etc.) production from year to year. When there are abundant food supplies during the fall and winter, squirrels survive the winter in good breeding condition and reproduce well. Conversely, when squirrel populations are high but mast production is poor, many squirrels starve or do not breed well the subsequent spring, and noticeable declines in the squirrel population and hunter success are observed. The most dramatic example of this occurred in 1968 when there was a severe mast failure. Mass “migrations” of squirrels were observed in September of 1968 as they attempted to locate new food sources outside their normal territories (Flyger, 1969). Unusually high numbers of squirrels perished as road kills during this time; it is presumed that many others ultimately starved to death later that fall and winter. As a result, hunter success in Tennessee plummeted from an all-time high in 1968-69 to an all-time low the next year.

PAST, PRESENT, AND FUTURE USE**Past Use**

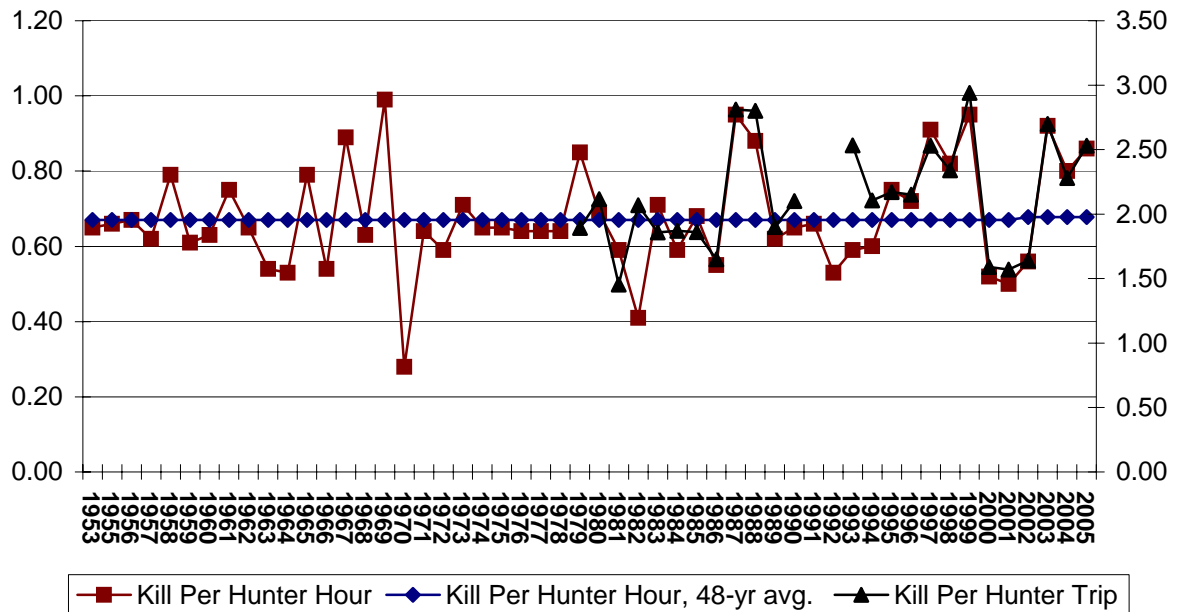
Years ago, squirrels were the most popular game species in Tennessee. In the late 1950's to early 1960's, squirrel hunters numbered from 200,000 to 250,000. With the increase of big game hunting opportunities and growing urbanization of Tennessee's population, hunter numbers dropped in the late 1960's to about 165,000. Squirrel hunter numbers since then have fluctuated, but have shown a slight decline over the last three decades, along with a steady decline in annual trips per hunter.

Present Use

From 2000 to 2005, mast crops fluctuated in the fair range except for 2003, which was the second lowest mast index in more than a decade. Squirrel populations climbed significantly as mast increased from 2000-2003. Following the poor mast crop in 2003, squirrel numbers dropped significantly and will likely be reflected in a poor harvest for 2004. The 2000 and 2001 hunting seasons were among the worst on record with hunters averaging about 1.6 squirrels killed per trip. Hunter trips during the last five years decreased from the last strategic plan period from an average of 1.2 million trips per year to about 950,000 trips per year. The number of hunters during this period dropped during this strategic plan period. 1995-2000 saw an average of approximately 140,000 squirrel hunters, while the 2000-2005 period averaged about 108,000 hunters (Figure 1). Harvest during this strategic plan period dropped from an average of 2.8 million harvested in 95-00 to about 1.8 million for the 2000-05 period (Figure 2). Although most numbers dropped during this past strategic plan period, this is probably a reflection of poor to fair mast crops and squirrel numbers.

Figure 1: SQUIRREL HUNTING TRENDS, 1955-2003

**Figure 2: TRENDS IN STATEWIDE
SQUIRREL HUNTING SUCCESS, 1953-2004**



Future Use

With overall hunter numbers and participation on a nationwide decline, it can be expected that interest and participation in squirrel hunting will continue to decline unless steps are taken to reverse the current trends. Small game hunting is an excellent tool for recruiting young hunters. Also, unlike many small game resources, squirrels have adapted well to land use changes and high populations exist throughout the state. Future use of this resource will depend largely on the implementation and success of this plan.

GOAL

To maintain current squirrel populations and reverse the trend of declining participation in squirrel hunting.

OBJECTIVE

To increase the average number of hunter trips to 1.3 million for 150,000 squirrel hunters between the 2005/2006 and 2011/2012 hunting seasons, while maintaining an average harvest of 2.4 squirrels per hunter trip.

I. Problem - Lack of hunter interest and participation.**Strategies**

1. Conduct designed surveys and/or utilize existing survey data to determine causes for hunter declines and use this information to develop an aggressive marketing campaign to recruit and retain hunters.
2. Publicize in print and all available media outlets the advantages of liberal seasons and bag limits and the value of youth involvement in squirrel hunting.
3. Provide a squirrel hunting forecast through the I & E Division.
4. Include information highlighting squirrel hunting methods, equipment needs, field care, table preparation of the meat, food qualities, and recipes on TWRA's website.
5. Schedule more "opening day" hunts on selected WMAs and refuges for youth hunters. This would involve selecting dates different from traditional statewide opening dates to increase interest in a particular hunt. Selected WMAs and refuges would hold their hunt on different dates, if possible.
6. Offer a free squirrel hunting day. This could be free for youth only, free for the disabled, or free for everyone. Investigate possibilities of having sponsored events similar to free fishing day activities.
7. Promote squirrel hunting with dogs including a video and using all media outlets. The organized squirrel dog hunting groups in the state could be utilized to help with this.

II. Problem - Hunters don't know where to successfully hunt for squirrels.**Strategy**

1. Identify areas open to public hunting and publicize through all I&E outlets.

III. Problem - Loss of land available to hunting.**Strategies**

1. Expand the public hunting access program above the present level.
2. Coordinate with the Tennessee Farm Bureau to slow the posting of private lands.
3. Acquire additional lands that provide hunting access and squirrel habitat.
4. Investigate legislation for tax incentive to provide public access to privately owned property.

IV. Problem - The lack of definitive information collected on squirrel populations and distribution makes it difficult to accurately monitor populations and harvest trends.

Strategies

1. Implement an online squirrel hunter and harvest survey to obtain information on squirrel hunter numbers, activity, and harvest on a timely annual basis.
2. Develop a predictive model that links gray squirrel, fox squirrel, and red squirrel populations to GIS habitat data layers and use this model to monitor squirrel habitat changes.

V. Problem - Violations of TWRA laws and regulations prevent accomplishment of program objectives and results in the loss of revenue.

Strategy

1. Provide an annual average of 1000 hours of law enforcement effort statewide to maintain a compliance index of 97% while checking 600 squirrel hunters.

VI. Problem - Distribution and populations status of fox and red squirrels may be decreasing.

Strategies

1. Conduct research to determine distribution and abundance of fox and red squirrels and determine trends in population and reasons for the trends.
2. Utilize online survey questionnaire to solicit information on distribution and relative abundance of fox and red squirrels.
3. Use data collected in Strategies 1 and 2 to determine feasibility of restoring red or fox squirrel populations.

VII. Problem - Lack of public knowledge on how to handle problems with nuisance squirrels.

Strategies

1. Develop a publication describing how to properly exclude and remove nuisance squirrels from buildings. This publication could be posted on the TWRA website as well as printed for easy distribution. Also provide a list of Animal Damage Control permit holders (with the permit holder's consent) by region and county on the website.
2. Promote techniques for dealing with nuisance squirrels using all I&E outlets.

METHODS

Projections: Projections for Objectives were based on what could realistically be expected if the squirrel program is successful in maintaining or slightly increasing hunter numbers. The objective harvest rate was established at a level consistent with past harvest success rates in years of moderate to good squirrel abundance.

Process: Task Force members for the squirrel Strategic Plan were: Archie Whitehead (Chairman), Larry Marcum, Russ Vandergriff, John Mike, Jeff Martin, Roger Applegate, and Don King. An initial meeting was held on May 11, 2005 in Nashville to discuss and develop goals and objectives. A second meeting was held on June 30, 2005 in Nashville to assess accomplishments and develop problems and strategies. A third meeting was held on August 19, 2005 in Nashville to finalize accomplishments and produce the first draft of the Strategic Plan.

Needs and Uses: Squirrel populations are highly dependent upon hardwood mast abundance. Thus, TWRA efforts are limited in affecting statewide squirrel populations. Presently, opportunities for quality hunting experiences exceed the demand.

Annual participation in squirrel hunting may vary, tending to be high in years when squirrels are abundant, and lower in years when squirrel populations are reduced. However, squirrel hunter participation can be influenced to some extent by mass media publicity, and is the primary means that TWRA has to influence hunter trends.

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CURRENT AND PROJECTED STATUS

Until the 1930's, nearly all the public fisheries in Tennessee were in rivers and streams. As reservoirs were impounded, many anglers shifted their interest to the booming reservoir fisheries. Consequently, most of TWRA's management efforts focused on reservoir management and trout waters, while somewhat ignoring warmwater stream resources. This was a common paradigm among southeastern management agencies (Stroud 1981). Recognizing a gap, the TWRA established a full-time stream management program in 1987.

The Streams Program was established to manage aquatic fauna and fisheries in riverine resources ranging from small streams to larger rivers. To date, this program has largely been involved in monitoring species distributions and managing prominent fisheries. There are approximately 60,000 miles of streams and rivers that flow through Tennessee's diverse landscape. Seven physiographic provinces create an incredible variety of habitat and productivity. For an in-depth description of Tennessee's stream resources refer to Etnier and Starnes (1993). Tennessee's aquatic fauna includes approximately 300 species of fish, 75 species of crayfish, and 130 species of mussels (Etnier and Starnes 1993; Parmalee and Bogan 1998; Williams and Bivens 2001). Tennessee's aquatic fauna is currently under stress, as 130 of the species are listed as in-need-of-management, threatened, or endangered.

Pollution continues to impact Tennessee's streams and rivers. The Tennessee Department of Environment and Conservation (TDEC) and TWRA are currently trying to protect the resource from pollution and alterations. Of the 30,000 stream miles assessed, TDEC currently lists 10,000 miles as being impaired (Denton et al. 2004). The biggest problem affecting streams and rivers is excess sediment delivered from poorly managed farms and construction sites. The problem is compounded by a lack of adequate buffer zones along stream channels. Thousands of miles of stream riparian zones currently lack buffer vegetation, and thousands more have riparian buffers that need to be expanded to accommodate shifting stream channels in the future. Loss of riparian zones increases temperature and siltation ultimately limiting the physical habitat of streams. Although the problem is overwhelming in scale, given adequate resources and support from landowners, riparian zones can be fixed. Cooperative programs among the Natural Resources Conservation Service (NRCS), U.S. Department of Agriculture (USDA), Tennessee Department of Agriculture (TDA), Tennessee Wildlife Resources Foundation (TWRF), TWRA, and numerous local and national conservation agencies are trying to improve riparian zones, but these programs need additional support to overcome this enormous task.

Additional growth and development of municipalities in Tennessee requires more water consumption. State protection of flowing water is limited to preventing withdrawals at extremely low flows. Maximum allowable withdrawals are routinely tested by municipalities and developers. Without established flow standards set for aquatic biota and recreational activities, TWRA's ability to manage stream resources for the public will be limited in the future.

Continued invasion by exotic species poses a substantial threat to streams. Examples of negative impacts resulting from introductions of exotic snails, mussels, crayfish, fish, parasites, and algae have all been demonstrated in Tennessee. Many exotics can substantially reduce numbers of, or even extirpate, native species by predation and competition. Others radically affect the food chain or local habitats leaving native species at a disadvantage. Boaters and anglers are likely vectors for the spread of these exotic species. Therefore, prevention through education is needed. Once introduced, many exotic species have the ability to spread on their own. Three species of Asian carp are currently spreading from the Mississippi River upstream into the Tennessee and Cumberland valleys, and impacts to native fauna are likely.

Sport fisheries will be impacted by these environmental problems, as well as social issues. Each year, more landowners with streams on their property are denying access to anglers. Because the majority of stream fisheries are located on privately-owned land, this trend will continue to jeopardize TWRA's ability to provide recreational opportunities in streams.

Warmwater streams and rivers represent a majority of the habitat for Tennessee's rare aquatic species. Warmwater streams also provide important sport fisheries for black bass, rock bass, catfish, sunfish, and suckers. All stream fishes are dependent on clean water, adequate flows, and quality habitat. These necessities are currently at risk in many of Tennessee's streams, and given the current rate of land development and apathy about damaged riparian zones, the outlook for these streams is not good.

Tennessee's coldwater streams are primarily located in the Blue Ridge physiographic province of the eastern part of the state. Including the Great Smoky Mountains National Park (GSMNP), there are about 850 miles of coldwater streams inhabited by wild (self-sustaining) populations of rainbow trout, brook trout, and brown trout. Wild trout primarily occur within the nine counties that border North Carolina, as well as parts of Sullivan and Washington counties. Additional populations of rainbow trout have been documented in spring-fed streams of the Highland Rim province in middle Tennessee. Although locally important, these isolated populations represent only a small fraction of the wild trout resource and only support small fisheries. Water withdrawals and pollution are the major threats to wild trout populations in privately-owned trout streams. Fortunately, most of Tennessee's wild trout streams are located within the Cherokee National Forest and GSMNP, thus their projected status is favorable because of the conservation planning by the U.S. Forest Service (USFS) and National Park Service (NPS). A long-term threat to wild trout may be acidification due to air pollution of streams in poorly-buffered watersheds.

About 75 streams, including both cold and warmwater streams, are stocked with 320,000 9-inch rainbow trout each year. These fish are stocked to supply trout to anglers in locations where trout do not reproduce naturally or to supplement wild trout fisheries with readily harvestable fish. In both cases, the stocking program relies on healthy streams to hold fish and adequate hatchery production to supply fish. The future of these fisheries will depend on angler demand for stocked fish, TWRA's ability to produce

them, and public access to the streams. TWRA's ability to provide a stocked trout program is currently in jeopardy because each year fewer landowners allow permission to fish. Over the last 15 years in middle Tennessee, access problems were the sole reason for the removal of six streams from the stocking program. Given this trend, the number of stocked streams will likely decrease unless landowners can be persuaded to allow access or new public stocking areas can be acquired.

Tailwaters below 12 tributary impoundments provide about 120 miles of trout habitat for put-and-take, put-grow-and-take, and even some wild trout fisheries in Tennessee. Tailwaters warrant intense management because they have more public access than typical stocked trout streams and they offer year-round fishing opportunities. About one million adult and fingerling rainbow trout and brown trout are stocked into tailwaters each year. While new tailwater introductions are unlikely, improved water quality below dams would present opportunities to improve some of the existing fisheries. For example, needed water quality improvements on the U.S. Army Corps of Engineer (USACE) projects would greatly improve the fishery and management options below Center Hill Dam. The long-term status of all tailwaters will depend on engineering solutions to improve water quality as human development continues to degrade water quality in the watershed upstream. Reservoirs can be expected to undergo future nutrient loading that will ultimately decrease the available dissolved oxygen in the tailwaters.

Both tailwaters and stocked stream fisheries depend on trout production at state and federal hatcheries. In recent years, the amount of trout stocked into streams and tailwaters has fluctuated around 400,000 pounds annually (Figure 1). Maintenance projects and production decreases to correct water quality issues at hatcheries contributed to the substantially lower production in 1992 through 1994. It is possible that a similar temporary drop in production will occur in future years as TWRA repairs water collection systems, replaces raceways, and adds oxygen injector systems at its hatcheries. TWRA managers have identified a need for an additional 26,000 lbs of trout for tailwaters, and 39,000 lbs for streams. TWRA's reservoir and community lakes program also need an additional 103,000 lbs of trout. Optimistically, planned hatchery improvements could produce an additional 50–90 thousand lbs of trout. TWRA would like to build an additional hatchery to produce an additional 100 thousand pounds of trout to meet all its needs. In addition to increasing production, TWRA has several possible strategies to more efficiently use trout within its programs. These strategies are discussed in the *Trout Management Plan for Tennessee* (Fiss and Habera, in progress).

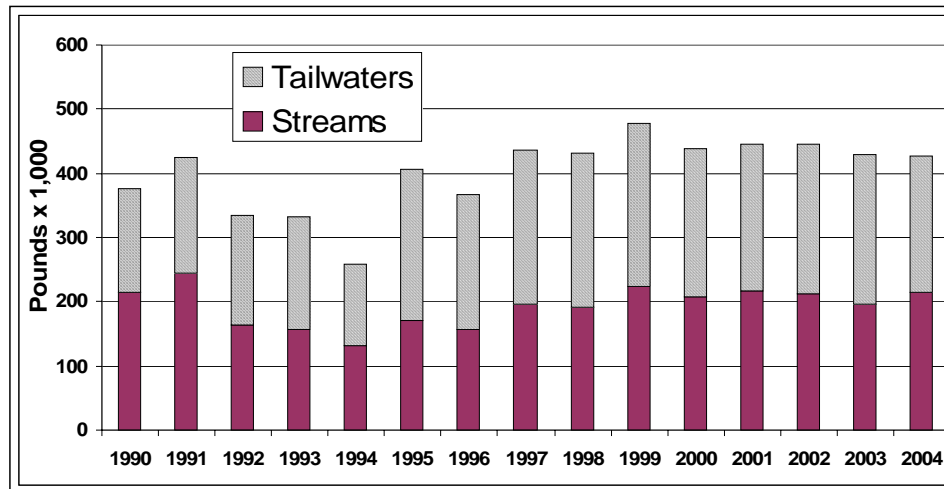


Figure 1. Pounds of trout stocked by state and federal hatcheries into streams and tailwaters.

PAST, PRESENT, AND FUTURE USE

A review of past strategic plans suggests that the number of stream anglers has been rising along with the state's population; however, comparable statistics describing long-term trends are not available. Similar survey methods have been employed since 1995 using phone surveys of resident anglers over 16 years of age (Jakus et al. 1998; Jakus et al. 1999; University of Tennessee, Human Dimensions Laboratory, unpublished data). These data were used as an index of angler use of stream resources in TWRA's 2000-2006 Strategic Plan (TWRA 2000). That plan set a goal of 250,000 resident participants over 16 years of age. From 1995 through 2004 participation has increased from about 217,000 to 280,000 anglers. As this trend continues we anticipate that the public's participation in stream fisheries will steadily increase for the next 15 years.

An increase in the number of stream anglers might be expected as the population of Tennessee increases. However, observations from national population demographics reveal that fewer younger individuals are getting involved in fishing (Responsive Management 1998), which means that despite more people in the state, fewer as a percentage will be fishing. The committee has set an objective of annually supporting 200,000 warmwater stream anglers and 165,000 trout stream and tailwater anglers by 2011. This objective was estimated based on a linear projection of the participation data between 1995 and 2004 (Figure 2).

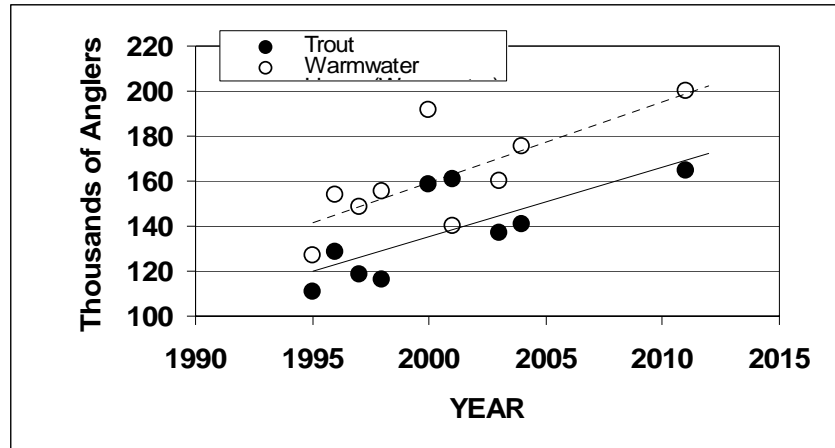


Figure 2. Estimated number of stream anglers by resource (Jakus et al. 1998; Jakus et al. 1999; University of Tennessee, Human Dimensions Laboratory, unpublished data). Projected estimates for 2011 are the objectives for this plan.

The number of trips by stream anglers fluctuated widely from 1995 to 2004 making it very difficult to predict future participation rates. The committee set an objective of 1.8 million warmwater trips and 1.5 million trout trips, which is approximately 9 times a year for each fishery (Figure 3). Providing opportunities that allow anglers several trips each year is important in keeping anglers interested in their sport.

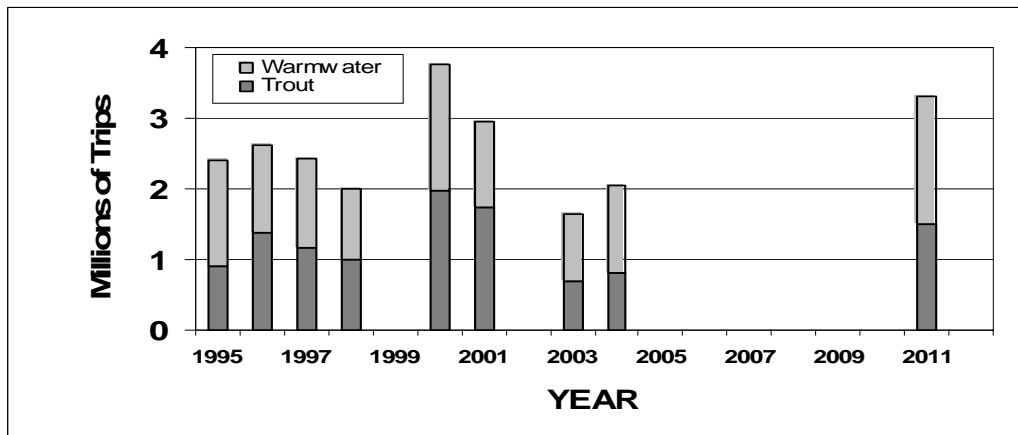


Figure 3. Estimated number of trips by resource (Jakus et al. 1998; Jakus et al. 1999; University of Tennessee, Human Dimensions Laboratory, unpublished data). Estimates for 2011 are the objectives for this plan.

It will be difficult for TWRA to maintain and increase the number of stream angling trips because many factors that influence use are beyond TWRA's management. The weather greatly affects angler's ability to fish streams. During wet years, streams flows are likely to be too high to allow fishing. Rainfall in the Tennessee Valley as indexed by sum of average daily discharge at Kentucky and Barkley dams was negatively correlated to the

number of trips to streams (Figure 4). Other factors that are beyond TWRA's management include gas prices or the amount of leisure time.

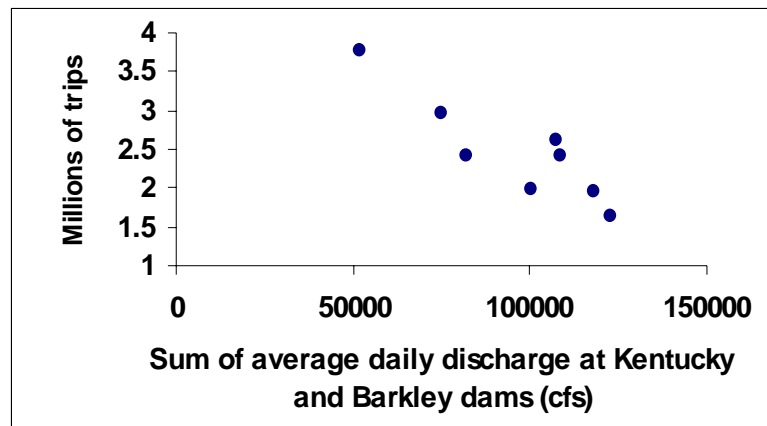


Figure 4. Negative relationship between stream fishing trips and rainfall in Tennessee as indexed by the sum of average daily discharge at Kentucky and Barkley dams, 1995 to 2004.

If this plan is successful in increasing the number of users, then that will further increase competition for limited resources, especially access. Anglers are less likely to go fishing if they think it will be too crowded. Expansion of stream fisheries will depend on available access. The history of hunting in Tennessee may be one that stream fishing is about to repeat. At one time, hunters could easily find places to get free permission to hunt. Now, hunters commonly have to pay fees, buy land, or limit their hunting to TWRA-owned Wildlife Management Areas. The limiting of fishing opportunities to leased areas or few public areas will ultimately decrease the number of people willing to participate in stream angling.

TWRA may need to consider new management strategies that will improve existing fisheries in order to increase angler participation. Many anglers want to fish in waters that are managed for high catch rates or trophy fish, yet relatively few streams are managed to promote the highest possible catch and trophy potential. TWRA may be able increase interest in stream fishing by adapting new management strategies such as the minimum lengths limits discussed in TWRA's Smallmouth Bass Management Plan (Fiss and Churchill 2003), or strategies that are developed for the Trout Management Plan (Fiss and Habera, in progress).

GOAL

Protect, restore, and enhance habitat and water quality in streams and rivers for fishes and other aquatic life, while providing a variety of quality angling opportunities.

OBJECTIVES

By 2011, increase the use of warmwater stream and river fisheries to 1,800,000 trips/year by 200,000 Tennessee residents, while maintaining a 75 % satisfaction level for fishing success.

By 2011, increase the use of stream and tailwater trout fisheries to 1,500,000 trips/year by 165,000 Tennessee residents, while maintaining a 75 % satisfaction level for fishing success.

By 2011, identify 3 streams or rivers that are threatened by flow reductions and develop flow regime models that identify the amount of flow required for aquatic life and recreation.

OPPORTUNITIES, PROBLEMS, ISSUES, AND STRATEGIES

I. Problem: Past and current use and development of land continue to impact streams resulting in water quality and physical habitat degradation.

Strategies

1. Fully fund TWRA's Riparian Conservation Project (#7708), which provides funds to help watershed conservation groups improve riparian habitat.
2. Educate developers, farmers, and municipalities about BMPs and encourage their use.
3. Fully fund and implement the Tennessee Landowner Incentive Program (TNLIP).
4. Provide Agency comment to USDA supporting full funding and implementation of the federal conservation programs that are authorized by the Farm Bill.
5. Participate in national and regional initiatives to improve aquatic habitat. (e.g. National Fish Habitat Initiative, and Southeast Aquatic Resources Partnership).
6. Establish a statewide habitat forum (preferably at the governor's level) to get all stakeholders involved in land use and development to be aware of the issues regarding stream habitat destruction. Involve developers, landowners, educators, municipalities, TDOT, and natural resource agencies and organizations.
7. TWRA should maximize its use of the Aquatic Resource Alteration Permit (ARAP) process by commenting on all potentially harmful projects, hiring additional staff if needed.

8. Support legislation that would require forested riparian buffers on all streams.
9. Establish better coordination with agencies involved in habitat restoration projects. A goal for coordination would be a one-stop clearinghouse to identify target areas, planned habitat improvements, and completed projects.
10. Work with USDA and Tennessee Department of Agriculture to maximize the effectiveness of their stream improvement programs. Pursue a proposal for a Conservation Reserve and Enhancement Program (CREP) area in Tennessee, and pursue a Technical Service Provider agreement with NRCS.

II. Problem: As the demand for water increases, Tennesseans must determine how much instream flow should be set aside to maintain aquatic resources.

Strategies

1. Establish the proper methods to develop flow models that consider withdrawals, construction of small impoundments, dam operations, and are reliable at predicting the amount of water needed for aquatic life.
2. Continue to work with TDEC to incorporate flow needs into ARAP process. TWRA will have an opportunity to provide comment on TDEC's Anti-degradation Policy in Fall 2005/Spring 2006.
3. Develop flow models for rivers that have a high likelihood of being targeted for withdrawals and have the potential to impact rare species or important fisheries.
4. Encourage the Governor to establish an Instream Flow Council in Tennessee to provide an opportunity to discuss flow issues among all stakeholders. The council would be a forum to gather stakeholders, determine priority areas, report on flow research, and educate everyone in Tennessee about flow issues. Ultimately the council might be used to resolve conflicts among user groups.
5. As several agencies have an interest in flow issues, TWRA should establish communication protocols with TDEC, USACE, U.S. Geological Survey (USGS), Tennessee Valley Authority (TVA), The Nature Conservancy (TNC) and others regarding instream flows. This should allow all agencies to work more efficiently.

III. Problem: TWRA needs current data on aquatic species to determine the status of populations, to identify critical habitats, and identify enhancement opportunities.

Strategies

1. Annually survey streams and rivers to determine the distribution and status of aquatic resources and use these data to identify problem areas. Report problems and provide data to TDEC for its 5-year watershed review.
2. Maintain and improve the Tennessee Aquatic Database System (TADS). A better functioning TADS would promote data sharing within TWRA and among agencies and allow GIS analyses of population data. GIS analyses would help identify threats and critical habitat.
3. Add auxiliary databases, such as TWRA collection permit reports and university museum collections, to TADS.

IV. Problem A lack of public, easily accessible, access areas is limiting use of streams and rivers.

Strategies

1. Update the existing TWRA database of public access locations. Use these data to update the existing list of needed access areas.
2. Use access database to educate public about where access exists. Distribute information on websites and brochures.
3. Resolve legal issues surrounding access to navigable streams.
4. Purchase land that will provide public access to stream and river fisheries. (3 locations/region/year).
5. All TWRA access points should be clearly marked with similar signage and be managed to provide an inviting atmosphere. Management of access points would include litter controls, grading road and parking areas, ramp installation and maintenance.
6. Establish fishing easements marked by “fishing permitted” signs on all stocked trout waters.
7. Develop incentives that would encourage landowners to provide fishing easements or to sell or will their stream property to TWRA.
8. Investigate state easements for fishing or other types of incentive programs (e.g., tax relief).
9. Establish an access stamp for stream anglers and use funds to purchase land for access.
10. Develop support from non-anglers to develop stream access.

V. Problem: Existing and future stream fisheries rely on stocked trout, but TWRA hatchery production is currently limiting these programs.

Strategies

1. Maintain and increase production at existing hatcheries by making improvements identified by TWRA hatchery managers and independent hatchery consultants.
2. Conduct research to determine minimum effective stocking rates.
3. Promote new fisheries that use fewer hatchery trout. Delayed harvest areas are examples of fisheries that can be sustained with relatively few hatchery trout.
4. Build a new trout hatchery to produce 100,000 pounds annually.
5. Purchase additional trout from private trout hatcheries.
6. Protect and enhance self-sustaining, wild trout fisheries to prevent the need for stocked trout.

VI. Problem: The public is poorly informed about stream issues resulting in decisions at all levels that adversely affect streams.

Strategies

1. Develop and distribute educational materials about stream stewardship to landowners and municipal planners.
2. Help teachers teach stream ecology by providing materials that follow educational standards.
3. Promote stream stewardship at invited presentations.

III. Problem: Aquatic nuisance species (ANS) threaten many native stream species.

Strategies

1. Educate the public about the harmful and expensive effects of invasive species.
2. Strengthen state laws designed to stop the spread of exotic species.
3. Establish and implement ANS plan for the prevention and monitoring of ANS species.

VIII. Issue/Challenge: Biologists need to collect fisheries data necessary for developing successful management plans.

Strategies

1. Collect data for important fisheries on a routine schedule. This includes studies to describe population dynamics of sportfish, and angler surveys to assess use, satisfaction, and preferences.
2. Develop and implement management plans for major fisheries (such as tailwaters, large river systems, or groups of similar streams).
3. Be responsive to anglers by soliciting their opinions on management issues through surveys, public meetings, creel surveys, or other means, and using their opinions in developing management plans and regulations.
4. Provide diverse stream fishing opportunities using regulations, but try to keep regulations as simple as possible.

IX. Problem: Many anglers and potential anglers are not aware of existing stream fishing opportunities in Tennessee. Less avid anglers need additional motivation.

Strategies

1. Promote stream fishing in Tennessee at a local, regional, and national level using professional advertising strategies. These efforts should target new anglers and persuade existing anglers to fish in Tennessee.
2. Develop maps identifying fishing opportunities for trout and warmwater species.
3. Complete the wild trout map. Update the stocked trout waters website. Add the tailwater maps to the website. Prepare a warmwater stream fishing map to include access points, navigable waters, and access rules.
4. Promote stream and river fishing at kid's fishing events, in presentations to schools and other youth organizations, and at sporting goods shows, fairs, and public audiences.

5. Inform state and local tourism agencies about stream fishing opportunities in their area so that they can help us promote fishing.
6. Include two segments per year on *Tennessee's Wildside* (television program) about stream fishing.
7. Publish two articles per year in *Tennessee Wildlife* magazine on stream fishing.
8. Promote the Tennessee Angler Recognition Program (TARP). Anglers targeting TARP species such as rock bass, brown trout, brook trout, and smallmouth bass will fish streams and rivers. Many of the existing TARP fish have been caught in streams and rivers.

X. Problem: Violations of TWRA laws and regulations negatively impact stream resources and result in lost revenue.

Strategies

1. Aquatic Habitat Protection Biologists will coordinate with state and federal agencies to enforce all applicable water pollution and habitat alteration laws and rules.
2. Wildlife Officers will inspect stream and river anglers and maintain a compliance index of 95%.

XI. Problem: Public health concerns about contaminants in fish threaten utilization of streams and rivers.

Strategies

1. List consumption advisories in TWRA's "Fishing Regulations" booklet and on website.
2. Cooperate with TVA and TDEC to systematically survey toxins in fish flesh through the Valley-Wide Toxic Monitoring Program.
3. Promote only catch-and-release angling at areas where fish may not be safe to eat.

XII. Problem: The recent increase in license fees will deter some anglers. The license cost is especially high for non-residents and this may affect their decision to fish while traveling for other reasons.

Strategies

1. Consider license types that would be more appealing to non-residents such as 1-day licenses and yearly licenses that expire one year from date of purchase.
2. Avoid additional license increases by seeking alternate funding sources (e.g. State tax revenue on sporting goods).

METHODS

This plan was developed by the Streams Planning Committee, which consisted of the following TWRA staff: Frank Fiss (Chair), Gray Anderson, Rick Bivens, Michael Clark, Mark Gudlin, C.J. Jaynes, Don King, Mike Murdock, George Scholten (meeting recorder), Travis Scott, Steve Seymour, and David Young. The committee also included non-TWRA professionals that work in stream conservation: Debbie Arnwine (TDEC), Sally Palmer (The Nature Conservancy), and Joey Woodard (TWRF). Committee meetings were held in Nashville on April 18 and June 20, 2005.

As instructed by the USFWS's Management Assistance Team, the committee used "brainstorming" techniques to develop and organize the goal, objectives, problems, and strategies. Priorities for problems and strategies were determined by committee vote. Copies of the draft plan were available for public review from November 18 to December 18, 2005. Comments were solicited through statewide news releases in order to determine the public's opinions on the plan. Only a few of the public comments pertained to the Streams Plan and they were limited to the subject of license fees. A final review by TWRA staff on January 10, 2006 called for minor changes in prioritization. The changes were included in this final draft.

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CURRENT AND PROJECTED STATUS

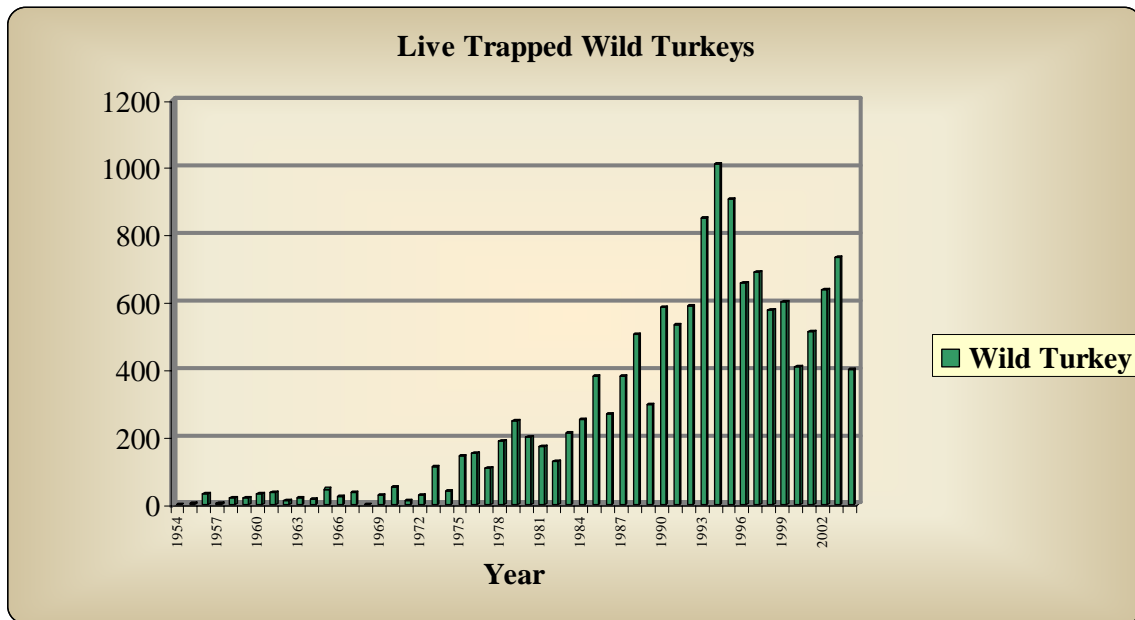
When the European colonization of Tennessee began in the mid 1800's, eastern wild turkeys (*Meleagris gallopavo*) were abundant. Several factors led to the decline of the wild turkey in Tennessee including market hunting, habitat modification and indiscriminate subsistence hunting. Early attempts at restoration involved the release of pen-reared birds into the wild. These birds did not possess the characteristics necessary to survive and successfully reproduce in the wild. No wild flocks were established as a result of these mass releases of pen-reared birds.

In the early 1950's, before the use of live-trapped wild birds for restoration, Tennessee had few huntable wild flocks. Adverse weather conditions during the peak poult rearing season affecting production on two or three local flocks could drastically reduce a significant portion of the total huntable population resulting in a decline in harvest. In those years when local populations declined, hunters often would not hunt because there were no other huntable flocks within a reasonable driving distance.

In 1951 there were only two counties in the state that harvested wild turkeys, Shelby and Polk. The total turkey harvest was only 14 birds taken in ten days of hunting. A survey of Tennessee's wildlife conducted in 1952 indicated that eastern wild turkeys were present in only 18 of Tennessee's 95 counties. Through intensive restoration efforts including the perfection of cannon netting techniques, wild turkey populations began to increase. Wildlife personnel were able to restore wild turkey populations to many areas which held suitable habitat without birds. The number of counties with wild turkeys present was increased to 58 by 1979; to 72 counties by 1983; and to all 95 counties by 1990. In addition to in state trap and relocation efforts, Tennessee has sent approximately 600 turkeys to Texas, Maryland and Canada in order to re-establish populations.

For the last 30 years the Agency's wild turkey management has focused on completing the restoration of the turkey and managing a newly established population. Great strides have been taken in the restoration of the wild turkey in Tennessee. Since 1951, we have live-trapped and relocated 13,856 wild turkeys (Figure 1). Turkey restoration is now essentially complete but local movement of birds to address landowner depredation complaints and problems of low poult production will continue in all regions throughout this planning period.

Figure 1

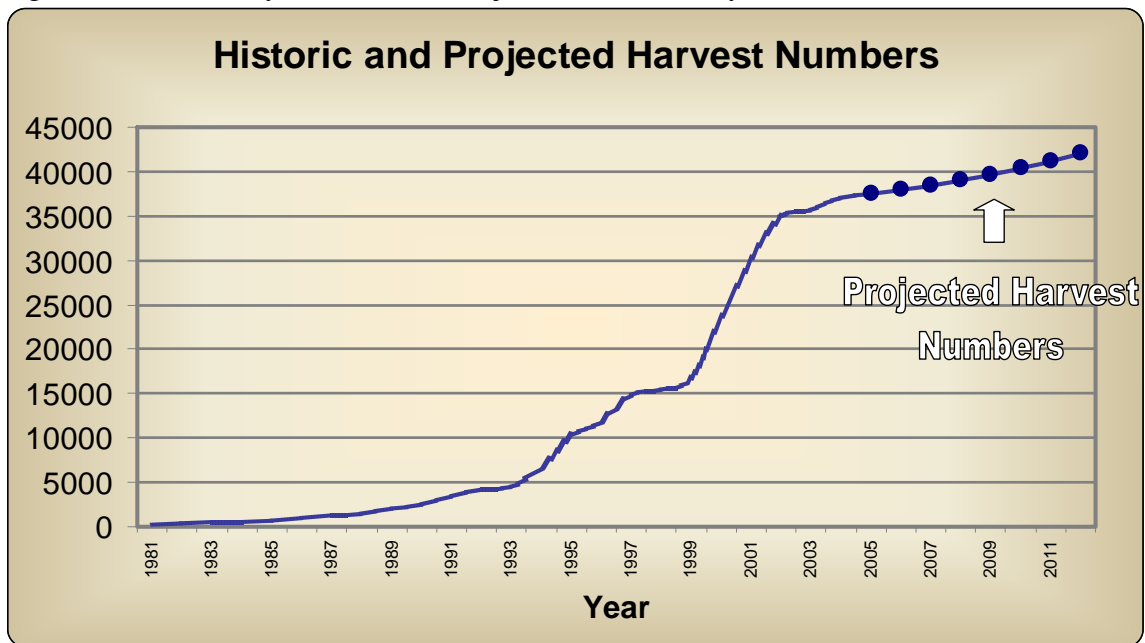


Now that the wild turkey has been restored to Tennessee, our goal is to ensure that a vigorous, self-sustaining population is maintained in all suitable habitats of the state. Turkeys will be managed to best meet the needs and desires of the people of Tennessee. Therefore, it is necessary to develop a long-range plan for managing Tennessee's wild turkey resource; this plan will direct wild turkey management for the anticipated future. This document is intended to develop a vision for the direction of the Agency's turkey management program, including goals and a range of strategies to meet those goals.

Certain parts of the state have experienced tremendous turkey population growth. The popularity of the turkey as a game species versus concern about turkey depredation in some areas of the state have brought about new challenges concerning turkey management. Large numbers of turkeys in certain parts of the state have brought about conflicts and in some instances economic losses. The strategies in this plan seek to resolve these issues while optimizing the worth of the wild turkey.

Wild turkeys are very difficult to census in all Tennessee habitats. Instead of direct counts, wildlife biologists have developed various indices based on mark-recapture and other methodologies. Many studies have shown that harvest or harvest/effort indices are the most accurate indicators of population numbers (Figure 2). Changes of these indices through time and understanding the factors that influence these changes are more important to biologists than a direct count at one point in time.

Figure 2 Wild Turkey Harvest and Projected Wild Turkey Harvest



In recent years, as a result of the wild turkey restoration efforts, Tennessee has a wider distribution of huntable flocks which can absorb declines in some local populations without a significant drop in the total harvest. Since weather conditions vary greatly across the state some flocks exist in areas that will be unaffected by the same storms which could be detrimental to poult survival in other localized flocks. Good production in these areas provides an alternate place for hunters to hunt when local populations are low.

PAST, PRESENT, AND FUTURE USE

From 1951 through 1970 the number of turkey hunters increased and decreased annually in relation to the wild turkey population levels of the few widely scattered, huntable flocks. Harvest numbers, hunter numbers, and total harvest followed turkey population trends. The hunter success rate for turkey hunters during this period averaged only 5 percent. From 1971 through 1993, the number of turkey hunters and the turkey harvest both increased due to the increased restoration efforts establishing more distributed huntable flocks. New harvest records have been set every year for the last twenty-two years and every year except two since 1977. In 2004, a record 33,962 birds were harvested (Figure 2) in 95 counties and the hunter success rate reached 27%. We have re-opened all portions of all 95 counties to turkey hunting since the spring of 2000. Traditionally Region I in west Tennessee has had the highest harvest because wild turkey flocks have been more widely distributed there for a longer period of time. In 1993, Region II in middle Tennessee led in harvest for the first time. Since 1993 Region II has continued to lead all other regions in the spring harvest with Region IV in east Tennessee in second place.

Estimated hunter numbers are shown in Figure 3. One goal of the Wild Turkey Plan will be to achieve 100,000 turkey hunters in the state of Tennessee. Future turkey harvest projections (Figure 2) were made based on harvest trends and hunter success rates from 1980 through 2005. In our projections, we have attempted to increase the spring turkey hunter success rate to 35 % of the hunters harvesting one bird. We would like to maintain this success rate as an average for the next six years.

Turkey hunter numbers continue to increase despite other hunter type numbers decreasing. For the next 15 years, public use of the wild turkey resource will continue to increase. This trend has been evident over the last 15 years.

Figure 3 Estimated Turkey Hunter Numbers

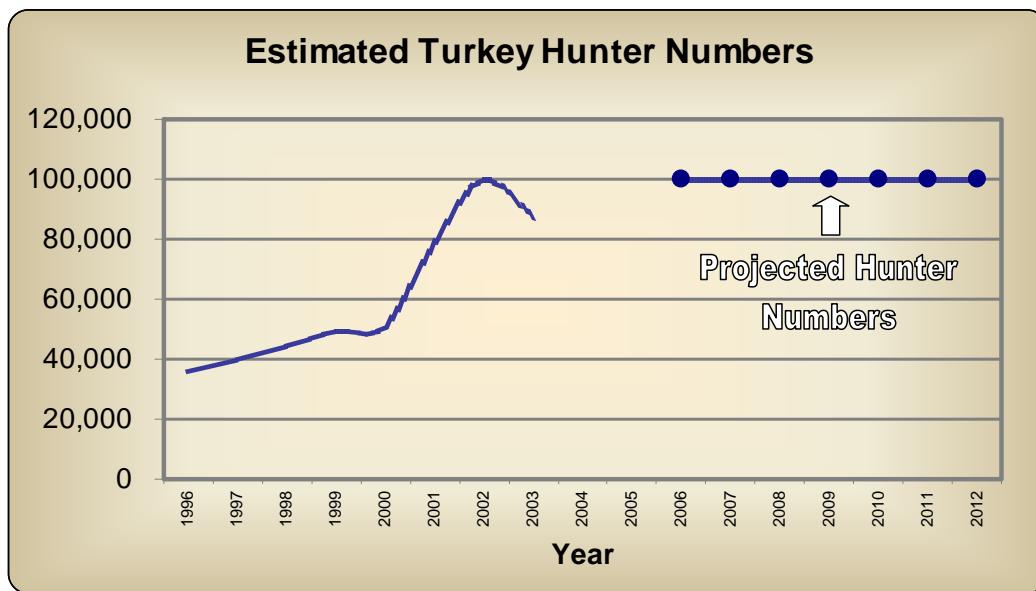
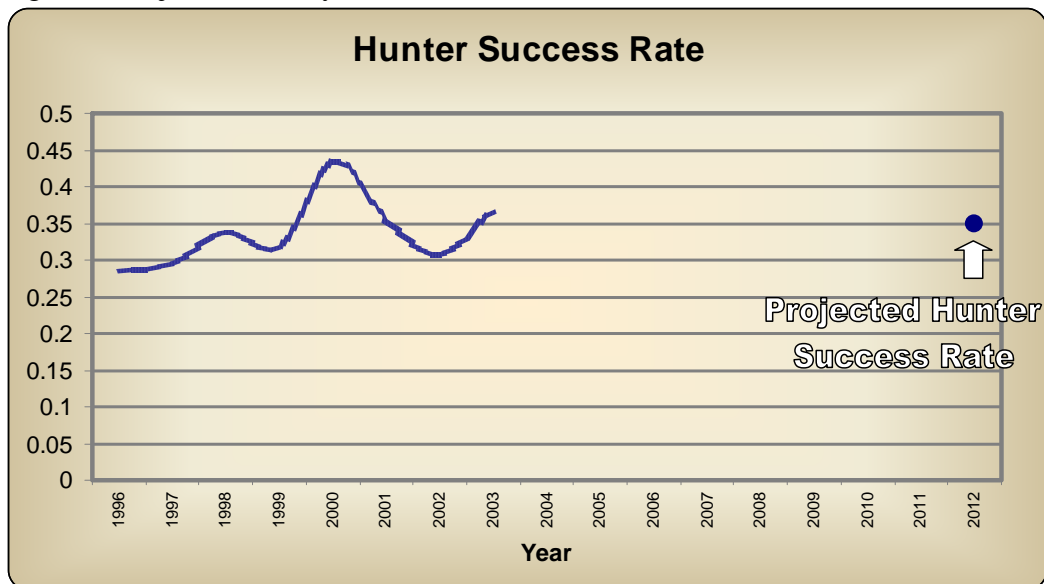


Figure 4 Projected Turkey Hunter Success Rate



GOAL

To establish and maintain a healthy wild turkey population, to increase its distribution where appropriate and to increase population levels to provide improved turkey hunting.

OBJECTIVES

Provide 800,000 hunting trips for 100,000 turkey hunters with a success rate of 35 % of the hunters harvesting one or more birds.

PROBLEMS AND STRATEGIES

I. Problem: Some hunters have difficulty gaining access to public and private hunting areas and do not have a place to turkey hunt. Hunter demand is too great on some public areas.

Strategies

1. Acquire more WMAs with turkey habitat for turkey hunting
2. Maintain liberal seasons to provide hunter opportunity
3. Seek legislation to provide tax incentives for recreational access to private lands.
4. Seek methods to encourage landowners to allow hunter access.
5. Inform public of other non-agency controlled public lands open to hunting.
6. Establish quotas on high demand areas when determined to be necessary.

II. Problem: The loss of turkey habitat reduces the potential for meeting the objectives of the turkey plan.

Strategies

1. Acquire additional areas with wild turkey habitat (WMAs, PHAs, etc) to protect turkey habitat and provide hunters a place to hunt turkeys in the future.
2. Manage WMAs to provide optimum wild turkey populations.
3. Lands purchased for non-game management should also be managed to benefit game species.
4. Provide technical assistance to improve timber management where turkey habitat is inadequate.
5. Monitor habitat trends with GIS. Use GIS technology to quantify existing turkey habitat conditions in Tennessee and compare current conditions to habitat suitability in future years.
6. Work with all available resource groups such as the U.S. Forest Service, U.S. Fish and Wildlife Service, National Wild Turkey Federation, private lands biologists and others to better enhance wild turkey habitats.

III. Problem: Conflicts between turkey and people in residential settings. Turkeys are becoming a nuisance in residential areas. Occasionally these birds become aggressive toward people.

Strategies

1. Discourage feeding of wild turkeys. Utilize brochures, magazine articles, seminars, radio and TV programs and other I & E efforts to discourage supplemental feeding of wild turkeys.
2. Reduce turkey populations in areas of chronic nuisance. Hunting will be promoted to help control populations and persuade wild behavior in turkeys, but hunting will not be an option in all locations where turkeys exist in Tennessee. Relocation of turkeys is expensive and not likely to be effective unless conducted persistently. The Agency will consider relocation of turkeys where they are a chronic and/or significant problem. The intent will be to relocate nuisance turkeys, not to expand their range.
3. Give technical advice on solving specific problems.
4. Develop a monitoring system to determine the extent and severity of turkey depredation

IV. Problem: Habitat management is needed on private land. A large portion of private land is not being managed in a beneficial manner for wild turkeys.

Strategies

1. Prepare materials and mass media presentations directed toward landowners for turkey management on private lands working with the Agricultural Extension Agents to disseminate the materials. Factual and scientific information should be used to educate the public on issues when they may be mis-informed.
2. Develop I&E efforts for general audiences about turkey management on private lands. Utilize all available information outlets to promote wild turkey management in Tennessee.
3. Publicize opportunities to manage habitat for turkeys in conservation programs such as WHIP, FLEP, etc...

V. Problem: Some turkey hunters experience poor success and tend to become discouraged and inexperienced hunters sometimes make mistakes that can cause serious safety and management problems.

Strategies

1. Work with sportsmen's and conservation groups to educate the public in hunting safety, techniques, ethics and turkey management.
2. Maintain a downward trend in turkey hunting accident rates. Stress turkey hunting safety and ethics in all the hunter education safety courses. Publicize dangers of turkey hunting and the need for safety consciousness on the part of turkey hunters prior to opening day of the spring season. Conduct workshops and seminars for turkey hunters stressing hunter

safety. Develop hunter safety awareness posters to be used at checking stations.

3. Develop and promote youth mentoring programs by concerned sportsmen's groups and hunters.

VI. Problem: The illegal hunting of established flocks is detrimental to the objectives of the wild turkey plan.

Strategies

1. Improve I&E efforts designed to inform the public about turkey management and program successes utilizing all practical outlets. Prepare a brochure on illegal hunting.
2. Maintain enforcement efforts as needed in the fall to reduce the illegal killing of turkeys during hunting seasons for other species.
3. Provide posters about reward program for reporting wild turkey violations.

VII. Problem: Turkey population low or declining in some areas.

Strategies

1. Monitor and identify non-hunting mortality factors.
2. Investigate population declines and conduct studies to determine causes of fluctuations and correct them if possible. Attempt to determine limiting factors in wild turkey range expansion.
3. Monitor disease outbreaks, working closely with the Southeast Cooperative Wildlife Disease Study on turkey disease and parasite issues. Provide public with information on wild turkey diseases.
4. Restock unoccupied suitable habitat to increase turkey distribution.

VIII. Problem: Incomplete management data on population density, distribution and habitat, harvest trends and hunter attitude.

Strategies

1. Obtain and maintain the necessary information about the status of the wild turkey population. Provide an annual assessment of wild turkey population status.
2. Improve the quality and quantity of data collected through better management of statewide big game checking stations and other surveys.
3. Continue to conduct the annual UT hunter survey. Survey the general public at least once every three years to determine the public's opinion and acceptance of Tennessee's wild turkey management programs.

METHODS

Goals and Objectives were selected in accordance with the Federal Aid guidelines. Our six man task force met as a group and developed desired goals. After considerable discussion it was decided that the program has been doing very well under the previous plan's goal and with some slight modifications this goal will work well for the new plan. This goal was unanimously adopted. The objectives of the old plan and ideas for new objectives were reviewed and discussed at length. We projected our numbers of hunters and turkey harvest in the future; this was based on our current growth rate of harvest and current growth rate of turkey hunters over the past 20 years. We assumed that our growth would not continue at the current rate over the next planning period. Most areas have reached maximum density levels and turkey populations are becoming stable. We based the hunter trips on the average number of trips per season reported in the 2004 UT hunter survey. All task force members agreed that the objectives were both reasonable and attainable within the time frame allotted.

Problems and Strategies were also discussed at length during the meeting of the task force. New problems were added and some old ones were deleted. The ranking of the selected problems in order of their importance in attaining the objective was decided by voting by all members of the task force. Members of the task force discussed strategies addressing each problem. Task force members included Randy Huskey, George Buttrey, Alan Peterson, Ben Layton, Mitch Bailey, Jim Zimmerman, and Allen Ricks.

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CURRENT AND PROJECTED STATUS:

The most limiting factors for the management of waterfowl populations are the quantity and quality of breeding and wintering habitats. The continued loss of wetlands, breeding and wintering, has resulted in a diminished carrying capacity for waterfowl and other wetland dependent species throughout the North American Continent. The migratory nature of waterfowl requires that essential habitat needs are met from Canada to Mexico and beyond. In 1986 an international plan was developed to manage habitat across this vast landscape. The North American Waterfowl Management Plan (NAWMP) is a partnership of federal, provincial/state and municipal governments, non-governmental organizations, private companies and many individuals, all working towards achieving better wetland habitat for the benefit of migratory birds, other wetland-associated species and people. NAWMP has established cooperative efforts to reverse the decline in waterfowl populations by protecting, enhancing and restoring wetland habitats. The plan is international in scope but habitat improvements are initiated on local levels. The Tennessee Wildlife Resources Agency (TWRA) began efforts to reverse the decline of local wetlands in 1988 with the development of Lauderdale Refuge. TWRA continues to restore, protect, and enhance wetlands and waterfowl habitat across the state. The results of these efforts and NAWMP are indicated by the increase of Tennessee's mid-winter duck survey from an all-time low 5 year average of 275,540 (1981-85) to an all-time high 5 year average of 510,133 (1996-2000). The rise and fall of waterfowl populations will continue with the quantity of water and quality of habitat within the wetland ecosystems. The continuation of cooperative efforts among the partners of NAWMP should reduce the dramatic changes in the population that were experienced during the past two decades.

Tennessee winters four populations of Canada geese (*Branta canadensis*). The Mississippi Valley Population (MVP) and the Eastern Prairie Population (EPP) which are found primarily in West Tennessee, the Southern James Bay Population (SJB) which winters on Kentucky Lake and the remainder of middle and east Tennessee. The Giant (resident) Canada goose (*B. c. maxima*) populations are now established on most major reservoirs in our State, especially in Middle and East Tennessee, and exist in scattered populations throughout the State. The SJB geese are still a major concern for waterfowl managers, but the spring population seems to be stable to slightly increasing. A few snow geese (*Chen hyperborea*) are now wintering in Tennessee, probably due to their explosive population increases during recent years.

PAST, PRESENT AND FUTURE USE**PAST USE**

Tennessee's average mid-winter (January) waterfowl inventories for the period of 1955-90 included 391,100 ducks and 52,522 Canada geese. The average midwinter inventories for the period 1991-2005 included 427,000 ducks and 29,847 Canada geese. The average number of ducks harvested in Tennessee for the period 1961-90 was 108,380. The

average number of ducks harvested in Tennessee for the period 1991-2004 has increased to 295,350. The average number of Canada geese harvested in Tennessee for the period 1983-99 was 23,934 (Gamble 1999). The average Canada goose harvest for the last five years (2000-2004) was 68,217.

The average number of active adult duck hunters in Tennessee from 1986-90,(season length of 30 days and daily bag limit of 3 ducks) was 18,680. . The average number of hunters from 1991-95 was 19,850, with a season – bag limit from 1991 – 93 of 30 days and 3 ducks; a season – bag limit in 1994 of 40 days and 4 ducks, and in 1995 a season – bag limit of 50 days and 5 ducks. The average number of hunters from 1996-2000 was 27,580 with a season length – bag limit in 1996 of 50 days – five ducks and from 1997-2000 it was 60 days with a bag limit of 6 ducks. The average number of duck hunters from 2001-2004 was 24,775 and the season length was 60 days. It appears that duck hunter numbers increased as the season length and daily bag limits increased to a certain point and then leveled off or declined slightly.

During the mid 1980's, the NAWMP was developed and monies for the protection, enhancement, and development of wetland habitat became available based upon the North American Wetlands Conservation Act (NAWCA). NAWCA grants were available through a ranking system where multiple partnerships and strategic locations received the best rank.

Since 1991-92, the Federal Government has been our most significant money partner for the restoration of wetlands by providing \$3.6 million for 11 wetland projects. The NAWCA grants accounted for 8 of the Federal partnerships with \$3.1 million.

Ducks Unlimited has been a major partner with Tennessee since 1985 by providing cash and in-kind services (\$754,000) for 17 completed wetland projects, 3 active wetland projects (committed \$126,000) and 15 wetland projects in the planning stage through year 2001 (with a commitment of \$169,000 for the first 4 of 15 projects).

PRESENT USE

Tennessee's January midwinter waterfowl inventories for the past five years included:

DUCKS		CANADA GEESE	
YEAR	MID-WINTER	YEAR	
	MID-WINTER		
2000-01	481,138	2000-01	13,644
2001-02	467,408	2001-02	138,173
2002-03	344,658	2002-03	16,658
2003-04	256,290	2003-04	12,732
2004-05	397,019	2004-05	12,187
5 Year Average =	389,303	5 Year Average =	38,679

Spring population estimates of Tennessee Giant Canada geese:

YEAR	NUMBER	
2000	69,778	
2001	69,752	
2002	60,599	
2003	57,488	
2004	53,254	
2005	72,105	6 Year Average = 63,829

Tennessee's harvest of all ducks and Canada geese for the past five years included:

DUCKS		CANADA GEESE	
YEAR	NUMBER	YEAR	NUMBER
2000-01	380,161	2000-01	118,400
2001-02	378,167	2001-02	53,900
2002-03	298,419	2002-03	73,892
2003-04	258,188	2003-04	36,794
2004-05	340,678*	2004-05	58,100*
5 Year Average = 331,122		5 Year Average = 68,217	

*Preliminary

Tennessee's total (potential) adult waterfowl hunters for the past five years included:

WATERFOWL HUNTERS	
YEAR	NUMBER
2000-01	26,500
2001-02	26,600
2002-03	22,500
2003-04	28,500
2004-05	21,500

In 1986 Tennessee enacted a wetland acquisition program to protect, enhance and restore our wetlands, and this program has provided additional habitat for many wetland species including waterfowl. Through July 31, 2005, 62,972 acres of wetlands have been acquired at an estimated total cost of \$65,085,027.

FUTURE USE

Future plans for Tennessee include providing foraging and other wintering habitat for approximately 797,000 dabbling ducks, 248,000 diving ducks and 82,000 Canada geese. These estimated number of ducks needing habitat was based on a formula used by the Lower Mississippi Valley Joint Venture Office to determine the distribution of wintering ducks within the states of the Mississippi Alluvial Valley (see appendix 1). The number of geese needing habitat was based upon the average number of all geese observed during

the Midwinter Waterfowl Survey for the period 1996-2005 (see appendix 2). The duck and goose habitat needs will be stepped-down to each TWRA Region (see appendix 3). Giant Canada Geese (residents) will be managed to maintain a spring population goal of 60,000 by continuing the early September goose season and by the translocation of nuisance geese to suitable areas.

A statewide, long range wetland habitat planning process has been developed for Tennessee which includes priority wetland habitat acquisition by TWRA, US Fish & Wildlife Service (USFWS) and the Corp of Engineers (COE) through the year 2007. Sixty-four project sites in Tennessee and one project site in Kentucky have been identified, including the present and proposed acreage with estimated costs.

Public use of the waterfowl resource should remain stable over the next 15 years.

Goals:

Provide a strategic Waterfowl Management Program and ensure the continued public use of the resource through the implementation of Regional Step-down Objectives.

Objectives:

1. Provide adequate foraging and other wintering habitat to meet the needs of 797,000 dabbling ducks for 110 days.
2. Provide adequate foraging and other wintering habitat to meet the needs of 248,000 diving ducks for 110 days.
3. Provide adequate foraging habitat for 82,000 Geese for 90 days.
4. Maintain a maximum of 60,000 Resident Canada Geese as determined by the Spring Survey.
5. Increase public and private hunting opportunity.
6. Provide seasonal Waterfowl Management Activities information to the public.
7. Meet or exceed the present financial support to the national and international effort to protect, restore, and enhance the breeding habitat.
8. Achieve the annual statewide wood duck banding quota.
9. Restore and enhance breeding duck habitat in Tennessee. (wood duck, hooded merganser)

Problems and Strategies:

I. Problem – The amount of available foraging habitat has not been determined.

Strategies

1. Annually determine the quantity of available foraging habitat on each public waterfowl management unit and private lands enrolled in the TPP Program by region.
2. Design efficient and accurate techniques to annually assess available foraging habitat.

3. Determine if existing waterfowl foraging capacity estimates (DUDs) assigned to crops (corn, rice, milo, millet, soybeans) moist soil, and bottomland hardwoods are accurate.

II. Problem – Inadequate waterfowl foraging and other wintering habitat may exist or distribution may not correspond to waterfowl use.

Strategies

1. If additional habitat is needed to meet foraging objectives, determine the number of acres by habitat type (native plants, planted crops, etc.) that are needed and the preferred geographic locations.
2. Develop management criteria to properly manage WMA's, refuges, and wetlands to provide optimum use and wintering habitat that will meet all physiological requirements of waterfowl.
3. Encourage waterfowl to occupy areas where use is now limited due to inadequate habitat (sanctuary, food production, and water management). Continue to establish mini-waterfowl refuges and resting areas in strategic locations (20-mile intervals in major rivers are preferred) with food production and water management capabilities.
4. Identify and acquire control of sensitive areas adjacent to or included in waterfowl refuges where current use is disruptive to the intent of all or part of the refuge.
5. Continue to seek new sources of funds for land acquisition, development, and management. Pursue joint venture cost sharing for acquisition projects with other agencies, including USFWS. Prioritize all acquisition needs to make the best use of available funds.
6. Continue to provide support for the Tennessee Partners Program in efforts to enroll 2500 acres each year. Encourage and support continuation of Farm Bill practices that protect existing and restore degraded waterfowl habitats.
7. Restore a natural-like hydrology and riparian vegetation on altered river systems where possible.
8. Encourage federal agencies to develop and/or manage suitable waterfowl habitats (including water management capabilities).
9. Discourage eradication of aquatic vegetation of significant value to waterfowl. Support research on methods of establishing aquatic vegetation of significant value to waterfowl.
10. Conduct periodic reviews of waterfowl refuges and WMA's by a team of independent waterfowl specialists to develop habitat management recommendations.
11. Provide annual training on waterfowl management techniques for waterfowl managers.
12. Assess waterfowl food consumption by non-waterfowl species on problem areas and develop strategies to reduce competition with waterfowl.
13. Assess the current contract farming practices on TWRA managed lands.

14. Conduct bi-monthly waterfowl surveys on refuges and continue the Mid-winter waterfowl inventory to determine if habitat corresponds to distribution.

III. Problem – Public hunting opportunities are inadequate.

Strategies

1. Determine the relationship between the total number and distribution of waterfowl hunters in the state and the hunting opportunities that are available on public areas.
2. Determine the number of hunters currently utilizing public hunting areas in order to estimate the additional acres needed to increase hunting opportunities by 40 percent.
3. Enhance habitat, improve access, and provide additional quality hunting sites on existing and recently acquired public lands.
4. Acquire new wetlands for public hunting as needed and in conjunction with waterfowl refuges.
5. Develop techniques for letting hunters without a blind know when blinds or blind sites on public lands are unoccupied and available to them.
6. Consider duck blind allocation systems that will more equitably distribute hunting opportunity. (e.g. Daily or weekly blind drawings, restricting private blinds on public areas, etc.)
7. Develop MOUs with TVA, COE, and others to provide hunting opportunities on reservoirs and river systems.
8. Develop and implement techniques for measuring duck hunter success on public lands.

IV. Problem – Local populations of Giant (Resident) Canada Geese cause depredation and public health and safety problems.

Strategies

1. Continue the spring aerial surveys to provide population estimates for resident Canada geese at least once every three years.
2. Implement hunting regulations that will focus on maintaining the population at or below 60,000.
3. Continue translocation of problem and/or nuisance Giant Canada Geese (residents) and assess the effectiveness of the translocations.
4. Band an appropriately distributed sample of resident geese each year to assist in determining the survival rate and the distribution and magnitude of harvest.
5. Develop capability of implementing other methods of resident Canada goose population control.
6. Continue to work through an MOU with Wildlife Services to address the conflicts with nuisance geese.

V. Problem – Dissemination of waterfowl related information needs to be improved.

Strategy

1. Provide timely information about WMA's to the public regarding crop planting, developments, flooding damage, waterfowl counts, hunting regulations, hunting opportunities, available hunting areas, etc. (coordinate with I & E).

VI. Problem – The loss of waterfowl breeding habitat continues to impact the continental waterfowl population.

Strategy

1. Continue to meet or exceed past levels of financial support to the North American Waterfowl Management Plan to continue to protect and enhance breeding habitat in Canada.

VII. Problem – Survival and population dynamics of wood ducks are not understood.

Strategy

1. Band 1,000 wood ducks annually during the pre-season period (June, July, and August) with banding locations well-distributed throughout the state.

IX. Problem – The loss of natural wood duck and hooded merganser nesting/brood rearing habitat has restricted populations.

Strategies

1. Protect and enhance riparian zones to increase wood duck nesting and brood-rearing habitat.
2. Promote agency and public sponsored wood duck nest box programs and proper installation, maintenance, and placement of boxes in suitable areas.

IX. Problem – Without monitoring, progress of the strategic plan cannot be assessed.

Strategies

1. The State Waterfowl Coordinator will annually assimilate the accomplishments of this plan as reported by Regional personnel.
2. The State Waterfowl Coordinator will annually recommend actions to Regional Managers, necessary to accomplish the objectives of the strategic plan.

X. Problem – Illegal activities adversely affect the success of the waterfowl program.

Strategies

1. Consolidate WMA waterfowl regulations into the waterfowl hunting guide to reduce illegal activity caused by confusion over the statewide regulations and the inconsistency of WMA regulations.

2. Continue to provide 2,200 hours of law enforcement effort with a goal of 95% compliance index while checking 2,200 duck hunters.
3. Continue to provide 1,200 hours of law enforcement effort with a goal of 95% compliance index while checking 1,200 goose hunters.
4. Continue law enforcement programs, concentrating on early and late shooting, prohibited species, over limit, baiting and tagging.
5. Develop and teach new waterfowl enforcement techniques to veteran officers as needed.
6. Continue to provide waterfowl enforcement training for new officers.
7. Coordinate law enforcement efforts between WMA managers and officers to ensure that adequate enforcement efforts are achieved on WMAs.

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Appendix 1

State of Tennessee duck population goals expressed as millions of ducks

For 7 species¹ of dabbling ducks plus wood ducks

Region 1

$$(1.92 \div 100) \times (71.8 \div 100) \times (29.9 \div .85) \\ = 0.48498$$

Where: 1.92 is the average proportion² of the continental population for 7 species of dabbling ducks that occurred in Tennessee during the 1970-79 January Midwinter Inventory.

71.8 is the average proportion of the Tennessee harvest of 7 species of dabbling ducks that occurred in TWRA Region 1 during the 1971-80 period.

29.9 million ducks is the continental breeding population goal for the 7 duck species of interest.

.85 is an adjustment for winter mortality

Plus wood ducks

$$8,559 \times 10 \div 1,000,000 \\ = 0.08559$$

Where:

8,559 is the average 1971-80 wood duck harvest for TWRA Region 1.

10 represents the estimated harvest rate for wood ducks

1,000,000 to convert to million of ducks

$$\text{Region 1 Total for 7 species of dabbling ducks plus wood ducks} \\ = \underline{\underline{0.57057}}$$

Region 2

$$(1.92 \div 100) \times (13.1 \div 100) \times (29.9 \div .85) = 0.08848$$

Where: 1.92 is the average proportion² of the continental population for 7 species of dabbling ducks that occurred in Tennessee during the 1970-79 January Midwinter Inventory.

13.1 is the average proportion of the Tennessee harvest of 7 species of dabbling ducks that occurred in TWRA Region 2 during the 1971-80 period.

29.9 million ducks is the continental breeding population goal for the 7 duck species of interest.

.85 is an adjustment for winter mortality

Plus wood ducks

$$1,267 \times 10 \div 1,000,000 = 0.01267$$

Where:

1,267 is the average 1971-80 wood duck harvest for TWRA Region 2.

10 represents the estimated harvest rate for wood ducks

1,000,000 to convert to million of ducks

Region 2 Total for 7 species of dabbling ducks plus wood ducks
= **0.10115**

Region 3

$$(1.92 \div 100) \times (8.0 \div 100) \times (29.9 \div .85) = 0.05403$$

Where: 1.92 is the average proportion² of the continental population for 7 species of dabbling ducks that occurred in Tennessee during the 1970-79 January Midwinter Inventory.

8.0 is the average proportion of the Tennessee harvest of 7 species of dabbling ducks that occurred in TWRA Region 3 during the 1971-80 period.

29.9 million ducks is the continental breeding population goal for the 7 duck species of interest.

.85 is an adjustment for winter mortality

Plus wood ducks

$$1123 \times 10 \div 1,000,000 = 0.01123$$

Where:

1.123 is the average 1971-80 wood duck harvest for TWRA Region 3.

10 represents the estimated harvest rate for wood ducks

1,000,000 to convert to million of ducks

Region 3 Total for 7 species of dabbling ducks plus wood ducks
= **0.06526**

Region 4

$$(1.92 \div 100) \times (7.2 \div 100) \times (29.9 \div .85) = 0.04863$$

Where: 1.92 is the average proportion² of the continental population for 7 species of dabbling ducks that occurred in Tennessee during the 1970-79 January Midwinter Inventory.

7.2 is the average proportion of the Tennessee harvest of 7 species of dabbling ducks that occurred in TWRA Region 4 during the 1971-80 period.

29.9 million ducks is the continental breeding population goal for the 7 duck species of interest.

.85 is an adjustment for winter mortality

Plus wood ducks

$$1095 \times 10 \div 1,000,000 = 0.01095$$

Where:

1.095 is the average 1971-80 wood duck harvest for TWRA Region 4.

10 represents the estimated harvest rate for wood ducks

1,000,000 to convert to million of ducks

Region 4 Total for 7 species of dabbling ducks plus wood ducks
= 0.05958

Statewide dabbling duck plus wood duck population goal
=0.79656

For 6 species of diving ducks¹

Region 1

$$(1.92 \div 100) \times (60.1 \div 100) \times (11.0 \div .85) = 0.14886$$

Where: 1.92 is the average proportion² of the continental population for 7 species of diving ducks that occurred in Tennessee during the 1970-79 January Midwinter Inventory.

60.1 is the average proportion of the Tennessee harvest of 6 species of diving ducks that occurred in TWRA Region 1 during the 1971-80 period.

11.0 million ducks is the continental breeding population goal for the 6 duck species of interest.

.85 is an adjustment for winter mortality

Region 2

$$(1.92 \div 100) \times (11.0 \div 100) \times (11.0 \div .85) \\ = 0.027245$$

Where: 1.92 is the average proportion² of the continental population for 6 species of diving ducks that occurred in Tennessee during the 1970-79 January Midwinter Inventory.

11.0 is the average proportion of the Tennessee harvest of 6 species of diving ducks that occurred in TWRA Region 2 during the 1971-80 period.

11.0 million ducks is the continental breeding population goal for the 6 duck species of interest.
.85 is an adjustment for winter mortality

Region 3

$$(1.92 \div 100) \times (18.5 \div 100) \times (11.0 \div .85) \\ = 0.04582$$

Where: 1.92 is the average proportion² of the continental population for 6 species of diving ducks that occurred in Tennessee during the 1970-79 January Midwinter Inventory.

18.5 is the average proportion of the Tennessee harvest of 6 species of diving ducks that occurred in TWRA Region 3 during the 1971-80 period.

11.0 million ducks is the continental breeding population goal for the 6 duck species of interest.

.85 is an adjustment for winter mortality

Region 4

$$(1.92 \div 100) \times (10.4 \div 100) \times (11.0 \div .85) \\ = 0.02576$$

Where: 1.92 is the average proportion² of the continental population for 6 species of diving ducks that occurred in Tennessee during the 1970-79 January Midwinter Inventory.

10.4 is the average proportion of the Tennessee harvest of 6 species of diving ducks that occurred in TWRA's Region IV during the 1971-80 period.

11.0 million ducks is the continental breeding population goal for the 6 duck species of interest.

.85 is an adjustment for winter mortality

Statewide total diving duck population goal

= 0.247685

¹**dabbling ducks include:** mallard, pintail, black duck, gadwall, widgeon, shoveler, and green-winged teal

diving ducks include: redhead, canvasback, lesser and greater scaup, ring-necked and ruddy duck

²it is assumed that the 1.92 proportion of the continental population of diving ducks observed during the Midwinter Inventory and harvested in Tennessee was the same as for dabbling ducks

file: TN Regional duck goals 6-06-05

Appendix 2

Species	1996-05	1986-95	20-Year Avg.
Canada Goose	361,178	1,182,271	77,172
Snow goose	72,838	1,860	3,735
W.F. Goose	15,504	274	789
Total Geese	449,520	1,184,405	81,696

Appendix 3

Potential Regional and Statewide Waterfowl Objectives for Tennessee

Dabbling Ducks	Diving Ducks	Total Ducks	Canada Geese	Snow Geese	White-fronted Geese	Total Geese
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STRATEGIC PLAN 2006 - 2012**WATERFOWL****TWRA**

Region 1	571,000	149,000	720,000	70,000	4,000	1,000	75,000
Region 2	101,000	27,000	128,000	5,000	0	0	5,000
Region 3	65,000	46,000	111,000	1,000	0	0	1,000
Region 4	60,000	26,000	86,000	1,000	0	0	1,000
State Total	797,000	248,000	1,045,000	77,000	4,000	1,000	82,000

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